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BIOTA OF FRESHWATER ECOSYSTEMS. IDENTIFICATION MANUAL NO. 9. CRAYFISHES (ASTACIDAE) OF NORTH AND MIDDLE AMERICA

Horton H. Hobbs, Jr.

Smithsonian Institution
Washington, D.C.

May 1972

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Identification Manual No. 9

CRAYFISHES (ASTACIDAE) OF NORTH AND MIDDLE AMERICA

by

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Washington, D. C. 20560

for the

ENVIRONMENTAL PROTECTION AGENCY

Project # 18050 ELD

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May 1972

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FOREWORD

"Crayfishes (Astacidae) of North and Middle America" is the ninth of a series of identification manuals for selected taxa of invertebrates occurring in freshwater systems. These documents, prepared by the Oceanography and Limnology Program, Smithsonian Institution for the Environmental Protection Agency, will contribute toward improving the quality of the data upon which environmental decisions are based.

Additional manuals will include, but not necessarily be limited to, freshwater representatives of the following groups: amphipod crustaceans (Gammaridae), branchiuran crustaceans (*Argulus*), isopod crustaceans (Asellidae), leeches (Hirudinea), polychaete worms (Polychaeta), freshwater planarians (Turbellaria), aquatic dryopoid beetles (Dryopoidea) and freshwater clams (Sphaeriacea).

ABSTRACT

A brief introduction includes discussions of the systematic position of the 284 recognized species and subspecies of American crayfishes, their introductions into various regions of the United States and foreign lands, their habitats, methods of collecting and preservation, and problems of identification. Included in the series of illustrated keys that constitute the major part of the work are indications of the habitats and range of each crayfish. A list of selected references is followed by two appendices: one summarizing the distribution of each crayfish and the other consisting of a list of states and provinces with references to the crayfish that occur within them. An index to the taxa included constitutes the final section.

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SECTION I

INTRODUCTION

The keys presented here include all of the species and subspecies described from North America and Middle America prior to January 1, 1972, that I consider to be valid. In preparing them, I was unable to find characters that would distinguish several previously recognized taxa; consequently, they are omitted and are provisionally relegated to synonymy with previously described species. Most of the older synonyms have not been cited; however, attention is called to those taxa that are here considered invalid for the first time, or in recent works. Several species that previously have been relegated to synonymy have been resurrected. In instances in which it is known that the species cited actually represents a species-complex comprising several undescribed species and subspecies, such have been indicated, and, at the appropriate places, attention is called to those sections of the keys in which there is doubt as to the validity of the taxa recognized.

The trend that pervaded the literature dealing with crayfishes for almost three-quarters of a century of applying subspecific designations to superficially similar populations oftentimes led to what appear now to have been erroneous concepts of relationships. Unless there is evidence of intergradation between those populations that have been designated as subspecies, they are here accorded specific rank without presenting arguments for such apparently arbitrary decisions. The subgeneric designations employed in the genera *Cambarus* and *Procambarus* are diagnosed and discussed in Hobbs, 1969b and 1972, respectively.

Appended to the keys is an alphabetical list of the subfamilies, genera, species, and subspecies of the crayfishes occurring in North America and Middle America and the states in which each occurs. A second list of the states or provinces of the several countries and the crayfishes that are known to occur within their boundaries is also included.

I should be remiss should I fail to warn potential users of these keys that there exist a number of undescribed species, particularly of the genera *Cambarus* and *Orconectes* in the southeastern United States. For obvious reasons, none of them are included in the keys. Although only 284 species and subspecies are included here, at least an additional 50 taxa are known to exist, and descriptions of a number of them are in press, in manuscript form, or are being prepared by R. W. Bouchard, J. F. Fitzpatrick, Jr., H. H. Hobbs, Jr., R. D. Reimer, Alejandro Villalobos, and J. G. Walls.

Many of the following introductory directions of collecting, methods of preservation, and aids in identification are only slightly modified from Hobbs (1968b).

SYSTEMATIC POSITION OF THE FAUNA

The crayfishes of North America and Middle America are members of the holarctic family ASTACIDAE; they differ most conspicuously from their counterparts in the Southern Hemisphere, the PARASTACIDAE, in the modification of the appendages (first pleopods) of the first abdominal segment of the male as organs of sperm transfer. Three of the four subfamilies of the Astacidae are represented in the fauna: the ASTACINAE, largely confined to waters west of the continental divide in southwestern Canada and the United States; the CAMBARINAE, except for suspected or known introductions, found only east of the continental divide from New Brunswick southward to Guatemala, Honduras, and Cuba; and the CAMBARELLINAE that range from southern Illinois to the Gulf Coastal region, along the latter from Texas to Florida, and on the Central Plateau and Pacific slope of México.

INTRODUCTIONS

There is no evidence that crayfishes that have been imported from other parts of the world have become established in any part of North or Middle America, but at least three of the American species exist as breeding populations on islands or in other countries: *Orconectes limosus* in western Europe, *Pacifastacus leniusculus* in Sweden, and *Procambarus clarkii* in Hawaii and Japan. (See Penn, 1954.)

HABITS

Members of all of the crayfish genera, except *Troglocambarus*, have exploited a wide variety of epigean aquatic and semiaquatic habitats. In addition to frequenting various types of aquatic environments where most individuals secrete themselves during the day under stones, in dense mats of vegetations, or under debris, many dig burrows into the beds or banks of ponds or streams. Whereas they may seek refuge in such excavations during the daylight hours throughout most of the year, or in dry seasons when the water table sinks below the level of the bed, or when the surface waters freeze, they also may remain in these burrows for weeks or months. Frequently, during the breeding season, a pair of individuals share, at least for a time, the same burrow, and the female remains there until her eggs are laid and the young have hatched.

Other crayfishes (certain members of the genera *Procambarus*, *Fallicambarus*, and *Cambarus*) seldom, if ever, invade bodies of open water; instead, in areas where the water table is not beyond reach, they tunnel into the soil, often constructing complex, highly branching burrows with several openings to the surface. Animals with such habits are rarely seen except on warm, humid evenings when they may leave their tunnels and wander about over the surface of the ground. Such burrows are most often found in seepage or swampy areas or in low-lying flat-woods. They are especially abundant in the "Black Belt" of Alabama and Mississippi.

Only in North and Middle America and Cuba have crayfishes become so completely adapted to spelean environments that they have assumed a troglobitic existence. While there are many trogloxenes and a few troglophiles among the astacids, only 21 species and subspecies belonging to the genera *Troglocambarus*, *Procambarus*, *Orconectes*, and *Cambarus* are known to have become typically albinistic and to exist as troglobites, seldom appearing in epigean waters except following spring floods or heavy rains.

METHODS OF COLLECTING

In streams and other bodies of water that are shallow and not choked with vegetation, no implement provides better results than a 1/4-inch-mesh seine. In streams, if the seine is anchored downstream a few feet from the area to be sampled, and stones or debris are vigorously turned or agitated, the animals will "swim" and be carried by the current into the seine. Dragging the seine across pools or shallow ponds is also often most effective. In vegetation-choked, or deep bodies of water, wire traps with inverted cones and baited with meat often net fair samples of the crayfish population, particularly if left in the water overnight. D-ring dipnets are also often useful. Some of the most successful "crawfishing" accomplished in the United States is conducted in Louisiana where several modifications of a "lift net" are employed. This net consists essentially of two V-shaped metal rods (about six feet in length) tied together at their apices. The ends of the rods are affixed to the corners of a two-foot square net, and a lift-cord with a float is attached at the juncture of the rods. The bait (fish heads, scrap pieces of chicken, etc.) is centered on the net below the juncture of the rods. Several nets are then "set out" in a shallow slough or bayou, and the fisherman makes his way from one to another, quickly lifting the contraption and removing the crayfish that have been attracted to the bait.

Collecting at night in shallow water is usually most rewarding in that members of a number of species, most of the adults of which remain in their burrows or hidden in mats of vegetation or debris during the day, venture into open water at night. A headlight for spotting their eyes, which are ruby-red in reflected light, and a small dipnet are indispensable aids for collecting at night.

To collect burrowing crayfishes that seldom, or never, invade open water, several techniques have been found to yield some measure of success:

(1) The chimney should be removed, the burrow opened to the water table, and the opening sufficiently enlarged so that one's hand may be thrust below the water. If the water is thoroughly roiled and then left undisturbed for 2 to 5 minutes, the occupant often comes to the opening where its antennae may be seen at the surface of the water. The open hand should be thrust into the opening to "pin" the crayfish against the wall of the burrow. With careful manipulation, the crayfish can be seized with the fingers and withdrawn from the burrow. To avoid excessive digging, frequently water may be poured into the burrow to elevate the water level.

(2) In areas in which many burrows indicate the presence of a colony of crayfish, traps may be utilized with some degree of success, especially in relatively warm humid weather. Jars or cans, baited with meat or peanut butter, with one end removed and buried with the open end flush with the surface of the ground, are adequate, and if left overnight will frequently attract a few individuals.

(3) Collecting at night involves the least labor. Particularly following rains or when the humidity is high, the burrowing crayfishes come to the mouths of the burrows and often leave them to wander over the surface of the ground. With the aid of a headlight or some similar light source, they can be obtained in numbers by hand.

(4) For those species that construct a single vertical passage with only one or two openings to the surface, the use of a "yabby pump" is often most helpful. This device consists of a cast iron cylinder some three feet long and about six inches in diameter, open at one end and closed, except for two small holes (1/8 inch in diameter), at the other. Across the closed end is a foot-long bar (the handle) welded perpendicular to the axis of the cylinder. In places where the soil is sufficiently wet, the cylinder may be forced (open end down) into the soil around the vertical passage to a depth of one to three feet; then closing the two small holes with the thumbs, it is lifted quickly. Frequently the crayfish, along with much of its burrow, is removed from the substrate.

(5) To obtain some species, no substitute has been found for a laborious dissection of the complex (branching) burrows with the naked hand and the aid of a trowel or shovel. Gloves are almost useless, and, if used, the crayfish is often crushed before one realizes that it has been "cornered."

In capturing the troglobitic species, some type of headlight and a small dipnet are indispensable, and in some areas scuba equipment is essential. If one must resort to diving, a hand net with a sufficiently long trailing bag that might be folded against the rim of the net is highly recommended, for if the bag is too shallow, it is often exceedingly difficult to keep the crayfish in it when the initial swing is completed.

In all National Parks and in some states, collecting of crayfishes is prohibited, and they may be taken only after a permit has been obtained from the appropriate agency. Attention might also be called to the inappropriateness of trespassing on fenced or private property.

A plea is made to be judicious in collecting specimens where populations seem to be of limited size. Such restraint is particularly advisable in subterranean environments.

PRESERVATION

Crayfishes are perhaps best killed in 6 per cent neutral formalin, and should remain in the solution, depending on size, for 12 hours to a week. After being washed in running water for a few hours, they should be transferred to 70 per cent ethyl alcohol or 20 to 30 percent isopropyl alcohol. More relaxed specimens may be obtained by immediate preservation in 70 to 80 percent ethyl alcohol and, after a week or so, transferring them to fresh 70 per cent alcohol.

LITERATURE

Despite the number of items cited in the "References" section, this is a selected bibliography. Several of the citations contain original descriptions of species that have not been treated in subsequent works; however, an attempt has been made to restrict the references to summary studies in which diagnoses, illustrations, ranges, and/or ecological data are included. In Appendix II, existing regional keys that might be useful in identifying the faunas of the various countries or states are indicated by the references in parentheses.

IDENTIFICATION

As is true of many invertebrate and at least some vertebrate animals, the identification of juvenile crayfishes is difficult, and frequently, without locality data, cannot be made. Furthermore, in localities in which two or more closely allied species occur together, it is oftentimes almost impossible to distinguish between the younger members of populations. Compounding this difficulty among the male members of the subfamilies Cambarinae and Cambarellinae is the existence of a cyclic dimorphism associated with the reproductive cycle that, in the more northern representatives, occurs typically in a circadian rhythm. Among those species that have an annual reproductive cycle, the breeding ("Form I," or "first form") males of the population, at the end of their first season, molt and are transformed to essentially a juvenile morphology ("Form II," or "second form") that is retained until the advent of the next breeding season when the second semiannual molt returns them to the adult form (Form I). Thus between each breeding season there is a regression to the quasi-juvenile (Form II) stage which may have a duration of three to perhaps as long as six months. For those species that have a seasonal reproductive cycle, the entire male population may be in the juvenile or quasi-juvenile (Form II) stage throughout most of the summer months. In many of the species occurring in the lower temperate latitudes, there is no well defined breeding season, and, with staggered molting periods, the male members of a population consist of juveniles, quasi-juveniles (Form II), and adults (Form I) throughout the year.

Inasmuch as an individual may have three or more actively reproductive periods during its life span, and, with few exceptions, there is an increase in size of the individual with each molt, it is to be expected that quasi-juveniles (Form II) following their first or second breeding seasons are larger than an adult (Form I) male in its first. Consequently size alone cannot be used in distinguishing between first and second form males.

Except for members of the genus *Pacifastacus*, only breeding (Form I) males may be identified using these keys. These first form males may be distinguished from juvenile and second form males by the presence of one or more corneous, or horny, terminal elements (projections) on the distal ends of the first pleopods. These rigid pleopods (Fig. 2), in their usual position, extend from the base of the abdomen forward between the bases of the pereiopods and lie against the sternum of the cephalothoracic region. The first pleopods of the juvenile and second form males have no corneous terminal elements; the projections are more bulbous and much less clearly defined than in the first form males, and the entire pleopod is of similar texture. (Compare Fig. 3d-j). In females these pleopods are small and flexible or lacking.

Hopefully, in the future, it will be possible to construct a key to the female crayfishes, but until a satisfactory terminology can be developed for designating the elements of the secondary sexual characters, their identity must be based on correlation with the male or comparisons with specimens of which the identity is known.

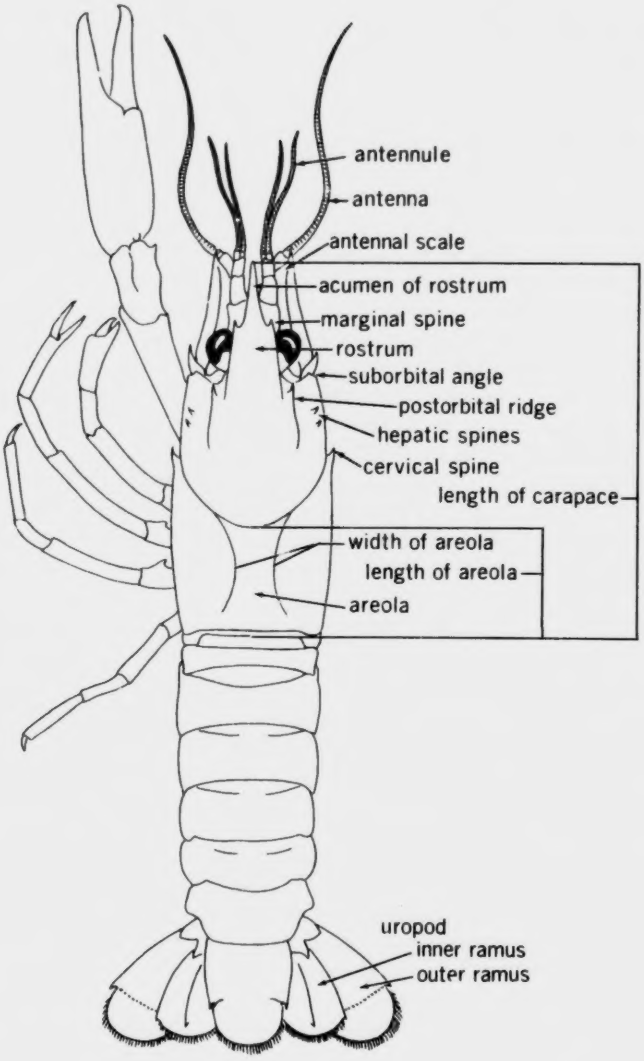
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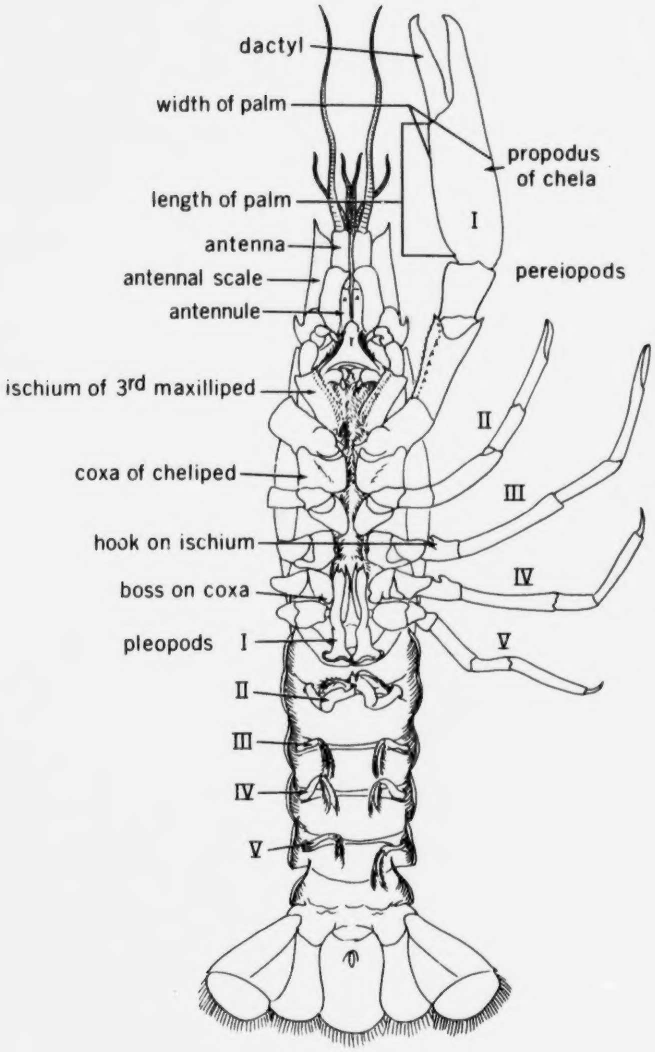
Fig. 1. Dorsal view of generalized male crayfish illustrating structures and measurements referred to in keys.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width of palm
propodus of chela
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antenna
antennal scale
pereiopods
antennule
ischium of 3rd maxilliped
II
coxa of cheliped
III
hook on ischium
IV
boss on coxa
V
pleopods I
II
III
IV
V

Fig. 2. Ventral view of generalized male crayfish illustrating structures and measurements referred to in keys.

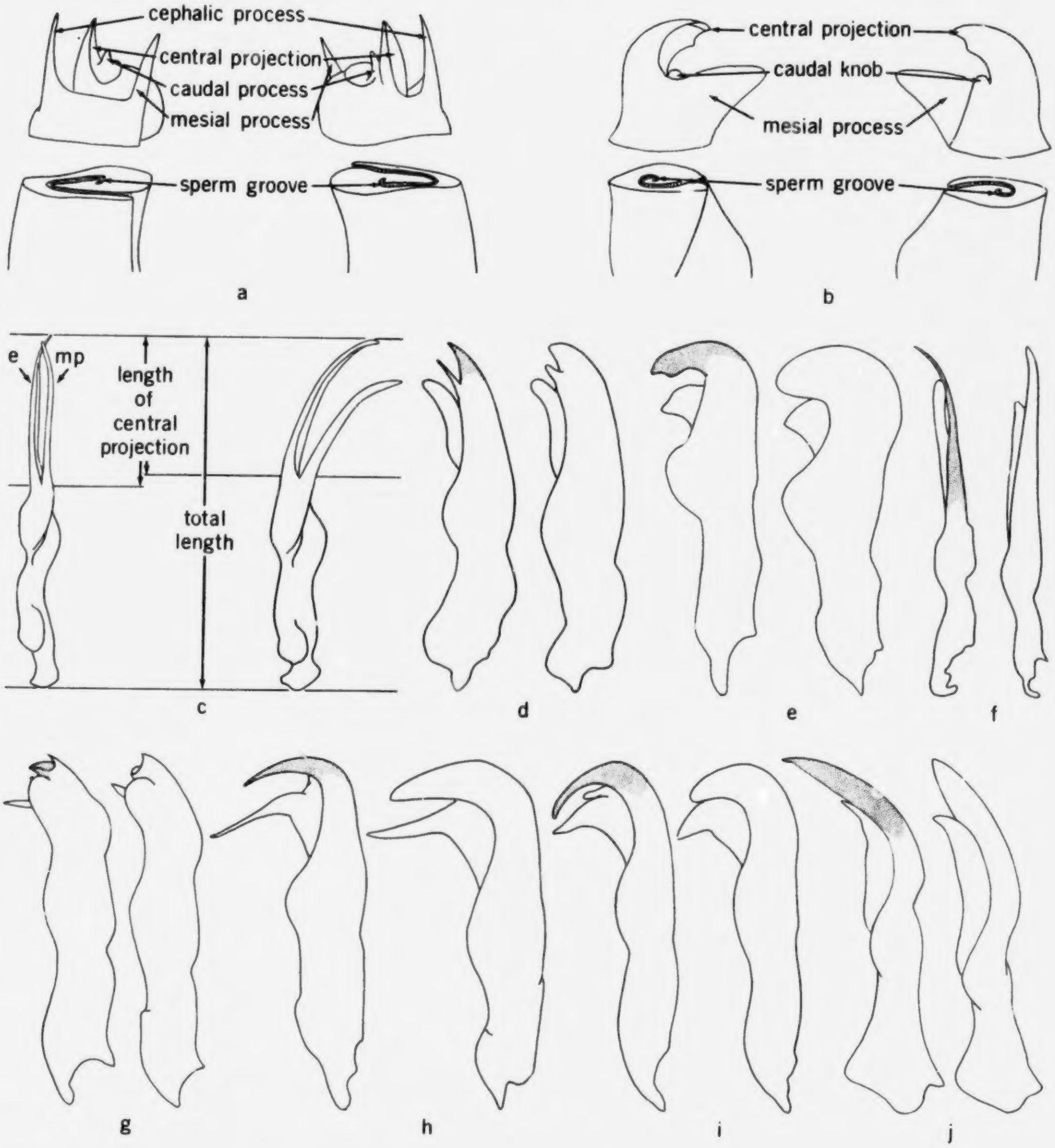

cephalic process
central projection
caudal process
mesial process
sperm groove
a
central projection
caudal knob
mesial process
sperm groove
b
e
mp
length of central projection
total length
c
d
e
f
g
h
i
j

Fig. 3. First pleopods of members of Cambarinae and Cambarellinae. a,b, Mesial and lateral views of terminal portions of generalized pleopods illustrating arrangements of terminal elements; c, Methods of measuring first pleopods (mesial view) in *Orconectes* (e, central projection; mp, mesial process); d-i, Lateral views of left pleopods of first and second form males, respectively, with corneous central projection shaded - d, *Cambarellus*; e, *Cambarus*; f, *Orconectes*; g, *Procambarus*; h, *Hobbseus*; i, *Fallicambarus*); j, Caudal view of left pleopods of first and second form males, respectively, in *Faxonella* (corneous central projection shaded).

The essential characters and methods of measurements utilized in the keys are summarized in Figures 1-3; in addition, most couplets are augmented by additional illustrations. Because of the extensive use of the first pleopod (unless otherwise indicated, all drawings are based on first form males) and the standard terminology that has been adopted for its several elements, Figure 3 has been prepared to provide an understanding of these terminal structures as they exist in the several genera. The central projection (shaded in Fig. 3d-j) of the first pleopod of the first form male is always corneous; the other terminal elements may or may not be so sclerotized. In the genus *Procambarus* (Fig. 3a,g), all four terminal elements are often present; in most members of the genera *Cambarus* (Fig. 3b,e), *Fallicambarus* (Fig. 3i), and *Orconectes* (Fig. 3c,f) and in all those of *Faxonella* (Fig. 3j) and *Hobbseus* (Fig. 3h) only two (mesial process and central projection) are present, while in *Cambarellus* (Fig. 3d) there are three -- only the cephalic process is lacking.

For convenience of description, the first pleopod is considered to hang pendant from the abdomen. Toward the attached end is proximal; toward the free end, distal; the side toward the head, cephalic; that toward the telson, caudal; that facing the corresponding pleopod of the pair, mesial; and that facing away from the midline of the body, lateral.

Regeneration.-- A large to moderate proportion of the crayfishes in a population loses one or more pereiopods during their life span, and, if the loss does not occur too late, the appendage is completely regenerated. The new appendage, however, seldom, if ever, is a perfect replica of the original one, and certain characteristics of the cheliped that have been utilized in the keys may become so altered as to lead one to an erroneous determination. Unfortunately, to my knowledge, there are no specific alterations that would enable a novice to recognize a regenerated chela; consequently, it is suggested that if one of the chelae of the specimen being identified is markedly different from the other and that of other individuals from the population, the characters of the chela that is more similar to those of other individuals should be used.

Equipment and Procedures that may be Helpful in Identification.-- For many crayfishes, a hand lens is adequate for observing the necessary characters. In attempting to identify members of the genus *Procambarus*, however, it will be discovered that the terminal elements of the first pleopod are often obscured by "subapical setae." Frequently, to make these elements visible, the setae must be removed, and it is suggested that this be done with the aid of a stereoscopic microscope in order to avoid dismembering one or more of the delicate terminals. To accomplish this, it is recommended that the pleopod be removed from the crayfish by severing the articular membranes at its base and transferring it to a dish of alcohol. By holding the pleopod at its base with a pair of forceps, the setae may be removed with a fine needle or slender forceps. Then, if the pleopod is oriented with the flattened mesial surface against the bottom of the dish, it is in a position to be compared with most of the illustrations of the pleopods included in the keys.

All of the illustrations of the pleopods have been made in lateral, mesial, or caudal aspect from the left member of the pair. Because of certain asymmetries, it is essential to examine the left pleopod. (NOTICE! REFERENCE IS MADE TO THE ANIMAL'S LEFT, not that of the observer.)

SECTION II

KEY TO THE MALE MEMBERS OF THE NORTH AMERICAN CRAYFISH GENERA (Except for *Pacifastacus*, all based on First-Form Male)

NOTE: Before beginning to use this key, it will be helpful to determine whether the first pleopods are symmetrically or asymmetrically arranged--see Figure 21.

1 Ischia of all pereiopods lacking hooks (Fig. 4f; see also Fig. 5a): ASTACINAE: *Pacifastacus* Bott, 1950 (p. 21)
Ischia of 1 or more pairs of pereiopods with hooks (Fig. 4a-c).. 2

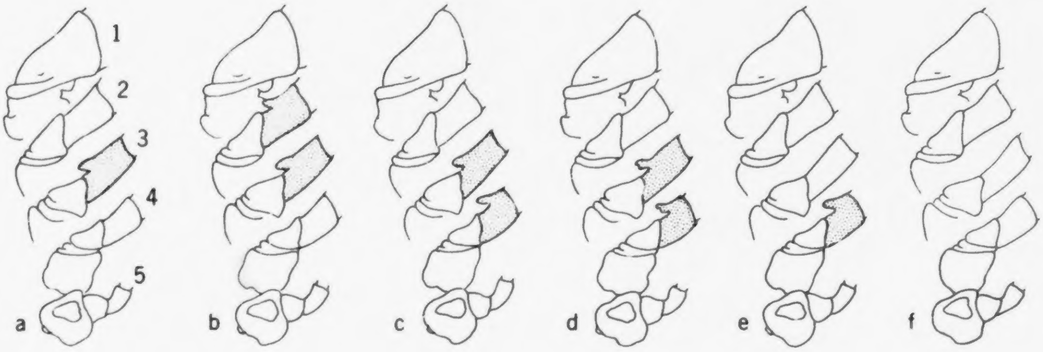
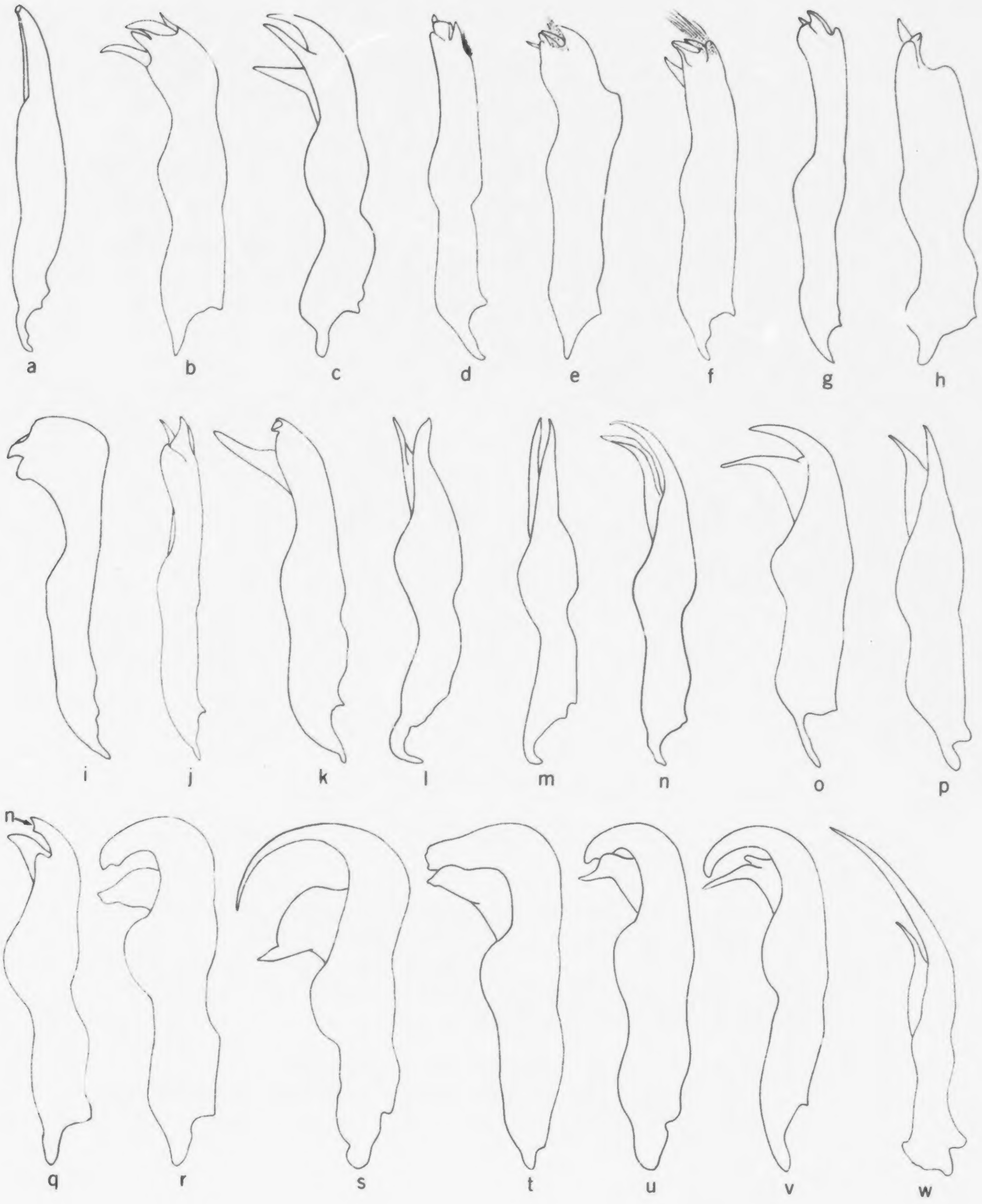


Fig. 4. Ventral view of basal portions of left pereiopods with ischia bearing hooks shaded.

2(1) Ischia of second and third pairs of pereiopods with hooks (Fig. 4b; see also Fig. 5c): CAMBARELLINAE: *Cambarellus* Ortmann, 1905a (p. 25)
Ischia of second pair of pereiopods never bearing hooks (Fig. 4a,c-e): CAMBARINAE............................. 3

3(2) Body pigmented; eyes faceted and pigmented................. 4
Body albinistic; eyes seldom faceted and with pigment greatly reduced or absent.....................................12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4(3) First pleopod terminating in 2 elements; long, slender central projection; short mesial process no more than 1/2 length of central projection (Fig. 5w); central projections of paired pleopods overlapping (Fig. 19):
Faxonella Creaser, 1933 (p. 29)

First pleopod terminating in 2 or more elements; if with 2, mesial process more than 1/2 length of central projection; central projections of paired pleopods never overlapping (Fig. 5d-v) except occasionally in *Fallicambarus dissitus* in which also recurved at more than 90 degree angle (Figs 81c, 82d).. 5

5(4) First pleopod terminating in 2 elements (Fig. 5h-i, l-p).... 6

First pleopod terminating in more than 2 elements (Fig. 5d-g, k,q,v).. 10

6(5) Distal 1/3 of first pleopod with prominent shoulder on cephalic surface (Fig. 5h), *or* central projection forming distally projecting triangular plate (Fig. 5j), *or* central projection arising from enlarged subterminal or terminal area (Fig. 5i): *Procambarus* Ortmann, 1905b (part) (p. 31)

Distal 1/3 of first pleopod lacking shoulder on cephalic surface; central projection never forming distally projecting triangular plate nor arising from enlarged subterminal or terminal area (Fig. 5l-p, r-u) 7

7(6) Coxa of fourth pereiopod lacking caudomesial boss (Fig. 6a)... 8

Coxa of fourth pereiopod with caudomesial boss (Fig. 6b-d).... 9

Fig. 5. a-v, Lateral view of left first pleopods; w, Caudal view of same. a, *Pacifastacus l. trowbridgii*; b, *Troglocambarus maclanei*; c, *Cambarellus puer*; d, *Procambarus fitzpatricki*; e, *Procambarus paeninsulanus*; f, *Procambarus a. acutus*, g, *Procambarus advena*; h, *Procambarus mexicanus*; i, *Procambarus truculentus*; j, *Procambarus pygmaeus*; k, *Procambarus paradoxus*; l, *Orconectes limosus*; m, *Orconectes propinquus*; n, *Orconectes immunis*; o, *Hobbseus cristatus*; p, *Hobbseus orconectoides*; q, *Cambarus pristinus*; r, *Cambarus b. bartonii*; s, *Cambarus reduncus*; t, *Fallicambarus hortoni*; u, *Fallicambarus fodiens*; v, *Fallicambarus macneesei*; w, *Faxonella creaseri*.

8(7) First pleopods, in resting position, deeply withdrawn between bases of pereiopods and largely concealed by dense setiferous mat extending from ventrolateral margins of sternum (Fig. 7a): *Hobbseus* Fitzpatrick and Payne, 1968 (p. 75)

First pleopods, in resting position, never deeply withdrawn between bases of pereiopods and never concealed by dense setiferous mat extending from ventrolateral margins of sternum (Fig. 7b): *Orconectes* Cope, 1872 (part) (p. 77)

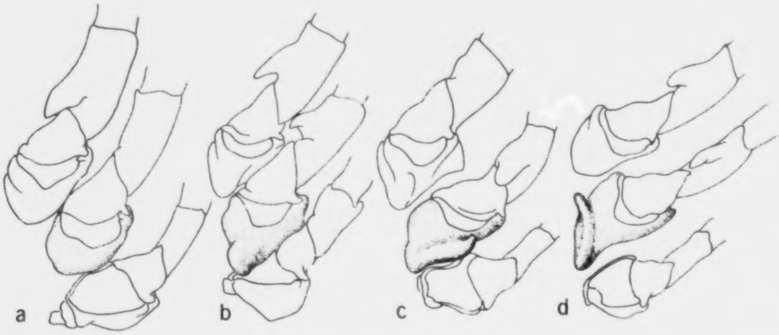

Fig. 6. Ventral view of basal podomeres of left third, fourth, and fifth pereiopods showing variations in coxae (stippled) of fourth (a, without boss; b-d, with boss). a, *Procambarus digueti*; b, *P. paeninsulanus*; c, *P. riojai*; d, *P. tenuis*.

9(7) Opposable margin of dactyl of chela with abrupt excision in proximal 1/2 (Fig. 8a): *Fallicambarus* Hobbs, 1969b (part) (p. 99)

Opposable margin of dactyl of chela without abrupt excision in proximal 1/2 (Fig. 8b-e): *Cambarus* Erichson, 1846 (part) (p.103)

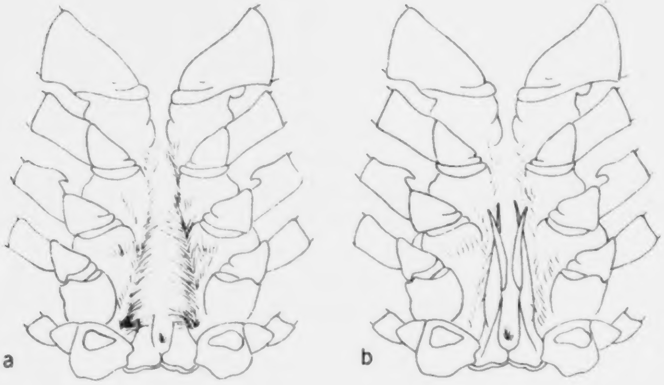

Fig. 7. Ventral thoracic region of a, *Hobbseus*; b, *Orconectes*.

10(5) Central projection of first pleopod bladelike, always directed caudally or caudodistally, and bearing subterminal notch (*n*) (Fig. 5q): *Cambarus* (part) (p. 103)

Central projection of first pleopod seldom bladelike, if so, directed laterodistally or lacking subterminal notch (Fig. 5d-g, v).. 11

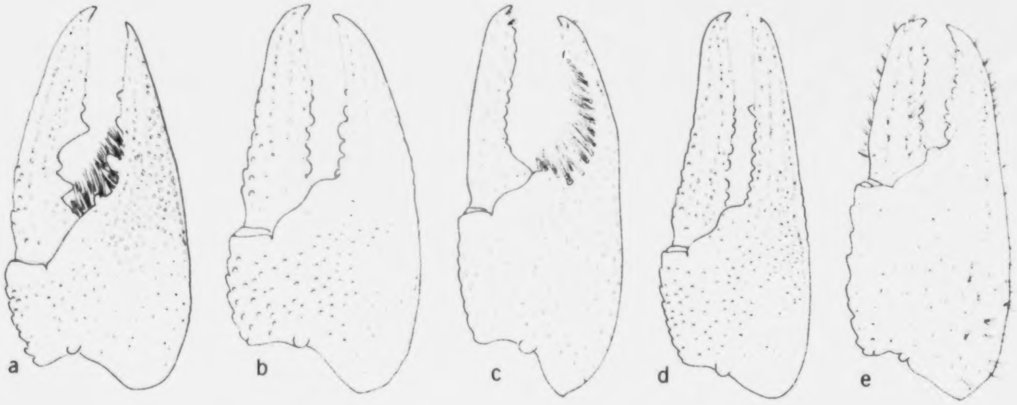

Fig. 8. Dorsal view of right chelae. a, *Fallicambarus oryktes*; b, *Cambarus latimanus*; c, *C. longulus*; d, *C. extraneus*; e, *C. brachydactylus*.

11(10) First pleopod with central projection and mesial process curved caudally at at least 90 degrees to principal axis of shaft of appendage (Fig. 5v): *Fallicambarus* (part) (p. 99)

First pleopod never with both central projection and mesial process curved caudally at angle of so much as 90 degrees to principal axis of shaft of appendage (Fig. 5d-g): *Procambarus* (part) (p. 31)

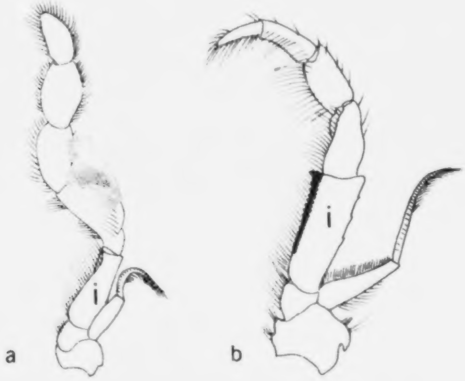

Fig. 9. Ventral view of left third maxillipeds. a, *Troglocambarus maclanei*; b, *Procambarus pallidus*. (i, ischium.)

12(3) Ischium of third maxilliped (See Fig. 2) without teeth on mesial (opposable) border (Fig. 9a; see also Fig. 5b):
Troglocambarus Hobbs, 1942a
Monotypic: *Troglocambarus maclanei* Hobbs, 1942. (Subterranean waters of peninsular Florida. Literature: Hobbs, 1942b)
Ischium of third maxilliped with teeth on mesial (opposable) border (Fig. 9b).. 13

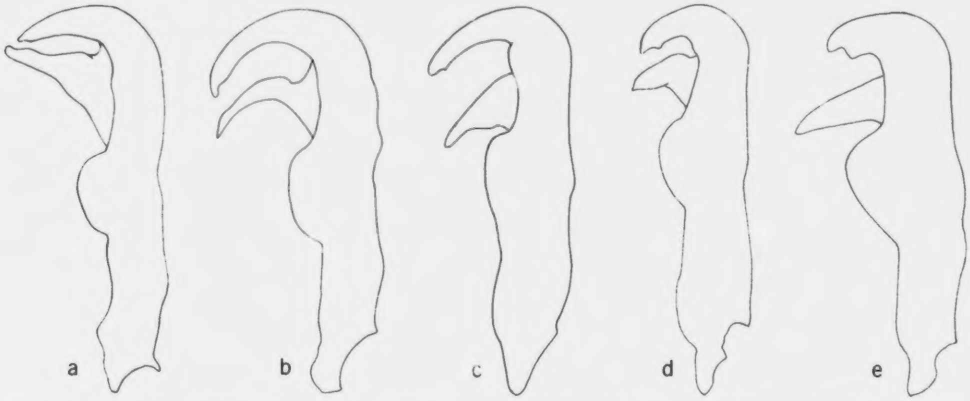

Fig. 10. Lateral view of left first pleopods. a, *Cambarus hamulatus*; b, *C. jonesi*; c, *C. setosus*; d, *C. hubrichti*; e, *C. cryptodytes*.

13(12) First pleopod terminating in 2 elements bent at no less than 90 degrees to principal axis of shaft of appendage (Fig. 10): *Cambarus* (part) (p. 103)
First pleopod terminating in 2 or more elements; if only 2, both never bent at angle so great as 90 degrees to principal axis of shaft of appendage (Fig. 11)......................14

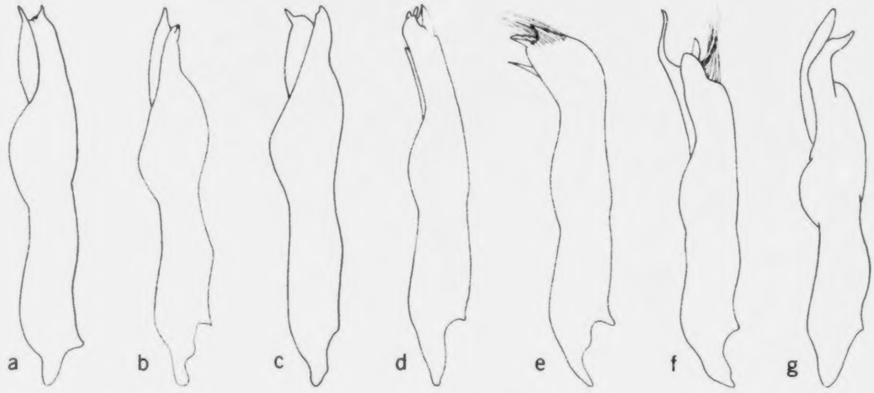

Fig. 11. Lateral view of left first pleopods. a, *Orconectes a. australis*; b, *O. pellucidus*; c, *O.i. inermis*; d, *Procambarus acherontis*; e, *P. l. lucifugus*; f, *P. milleri*; g, *P. pecki*.

14(13) First pleopod terminating in 2 elements, sometimes with minute rudiment of third (Fig. 11a); cephalic surface of appendage either lacking shoulder or with shoulder adjacent to base of central projection (Fig. 11b,c):
Orconectes (part) (p. 77)

First pleopod terminating in 2 (Fig. 11g) or more elements (Fig. 11d-f); if only 2, cephalic surface with strong, often angular, shoulder never contiguous with base of central projection (Fig. 11g): *Procambarus* (part) (p. 31)

KEY TO SPECIES OF GENUS *PACIFASTACUS*
(Applicable to Both Sexes)

1 Rostrum with single pair of marginal tubercles or spines (Fig. 12a-c).................. *Pacifastacus leniusculus*... 2
(The subspecies of *P. leniusculus* that have been described are not clearly defined, and their ranges overlap--at least in part due to introductions--to such an extent that it is questionable that they should be recognized. Only the most "extreme" representatives of the three can be identified here.)

Rostrum with at least 3 pairs of marginal spines (Figs 12d, 13).. 4

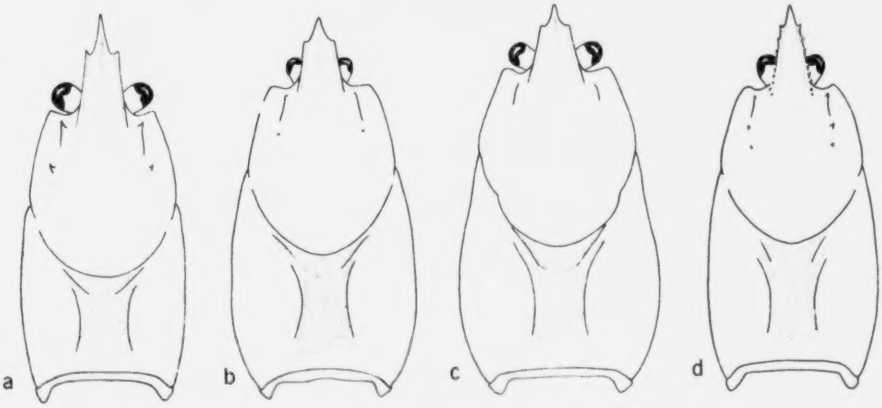

Fig. 12. Dorsal view of carapaces. a, *Pacifastacus l. leniusculus*; b, *P. l. trowbridgii*; c, *P. l. klamathensis*; d, *P. connectens*.

2(1) Postorbital ridges almost always spiniform cephalically and with pair of spines at posterior bases; length of acumen almost always greater than width of rostrum at level of marginal spines (Fig. 12a; see also Fig. 14e):
Pacifastacus leniusculus leniusculus (Dana, 1852)
(Streams and lakes in British Columbia, California, Idaho, Nevada, Oregon, and Washington. Literature: Faxon, 1885; Riegel, 1959)

Postorbital ridges rounded or tuberculiform cephalically and with or without low tuberculiform prominences at posterior bases; length of acumen seldom equal to width of rostrum at level of marginal spines, never in *P. l. trowbridgii* (Fig. 12b,c)... 3

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3(2) Base of postorbital ridges with tubercles (Fig. 12b; see also Fig. 5a):
Pacifastacus leniusculus trowbridgii (Stimpson, 1857) (Streams and lakes in British Columbia, California, Idaho, Nevada, Oregon, and Washington. Literature: Faxon, 1885; Hagen, 1870; Riegel, 1959)

Base of postorbital ridges without tubercles (Fig. 12c):
Pacifastacus leniusculus klamathensis (Stimpson, 1857) (Streams and lakes in British Columbia, California, Idaho, Oregon, and Washington. Literature: Faxon, 1885; Riegel, 1959)

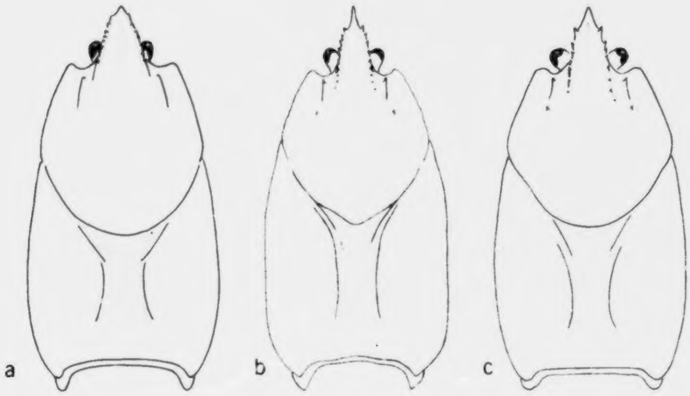

Fig. 13. Dorsal view of carapaces. a, *Pacifastacus gambelii;* b, *P. nigrescens;* c, *P. fortis.*

4(1) Dorsal surface of palm of chela with two conspicuous clusters of setae (Fig. 14a,b).................................... 5

Dorsal surface of palm of chela without conspicuous clusters of setae (Fig. 14c,d).................................... 6

5(4) Postorbital ridges with 1 or 2 pairs of posterior spines or tubercles; rostrum lacking median carina (Fig. 12d); dorsal surface of chela with comparatively prominent tubercles (Fig. 14a): *Pacifastacus connectens* (Faxon, 1914) (Streams in Idaho and Oregon. Literature: Faxon, 1914)

Postorbital ridges lacking posterior spines or tubercles; rostrum often with median carina (Fig. 13a); dorsal surface of chela with minute tubercles (Fig. 14b):
Pacifastacus gambelii (Girard, 1852) (Streams and lakes on the Pacific slope and in the Missouri River drainage in California(?), Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Literature: Hagen, 1870; Riegel, 1959)

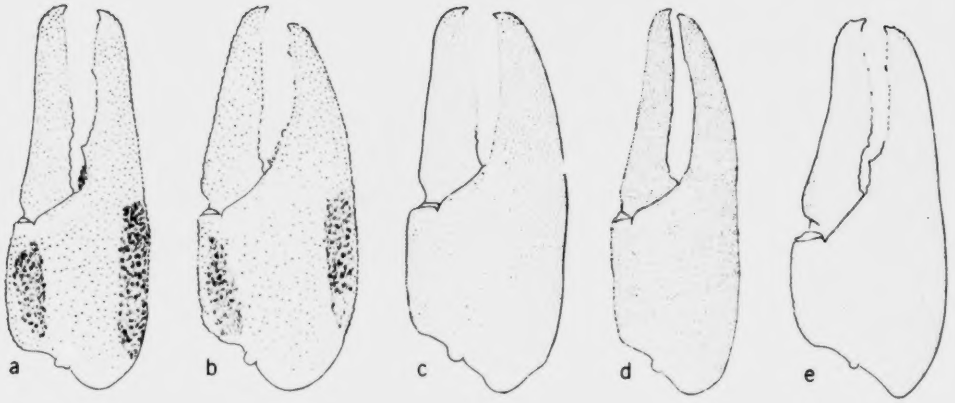

Fig. 14. Dorsal view of chelae. a, *Pacifastacus connectens*; b, *P. gambelii*; c, *P. fortis*; d, *P. nigrescens*; e, *P. l. leniusculus*.

6(4) Width of palm of chela equal to, or greater than, length of mesial margin (Fig. 14c; see also Fig. 13c):
Pacifastacus fortis (Faxon, 1914)
(Streams in Shasta County, California. Literature: Faxon, 1914; Riegel, 1959)

Width of palm of chela less than length of mesial margin (Fig. 14d; see also Fig. 13b):
Pacifastacus nigrescens (Stimpson, 1857)
(Streams in the vicinity of San Francisco, California. Literature: Faxon, 1914; Hagen, 1870; Riegel, 1959)

KEY TO SPECIES OF GENUS *CAMBARELLUS*
(Based on First-Form Male)

NOTE: In using this key, the first pleopod must be viewed mesially. For comparative purposes, all of the illustrations of this appendage are made of the left member of the pair.

1 Mesial process of first pleopod without longitudinal groove along mesial surface of apical 1/3 (Fig. 15)............... 2
Mesial process of first pleopod with longitudinal groove along mesial surface of apical 1/3 (Fig. 16)............... 7

2(1) Terminal elements of first pleopod almost straight and directed distally (Fig. 15a): *Cambarellus shufeldtii* (Faxon, 1884) (Lentic and sluggish lotic habitats in the Mississippi drainage system of southern Illinois, Tennessee, Arkansas and Louisiana; in the Red River system in Louisiana and Texas; and in the Pascagoula and Pearl River systems in Mississippi. Introduced into Rapides, St. Bernard and St. Tammany parishes, Louisiana. Literature: Black, 1965; Hobbs and Marchand, 1943; Penn, 1959)
Central projection of first pleopod always curved and other terminal elements never directed distally (Fig. 15b-f)..... 3

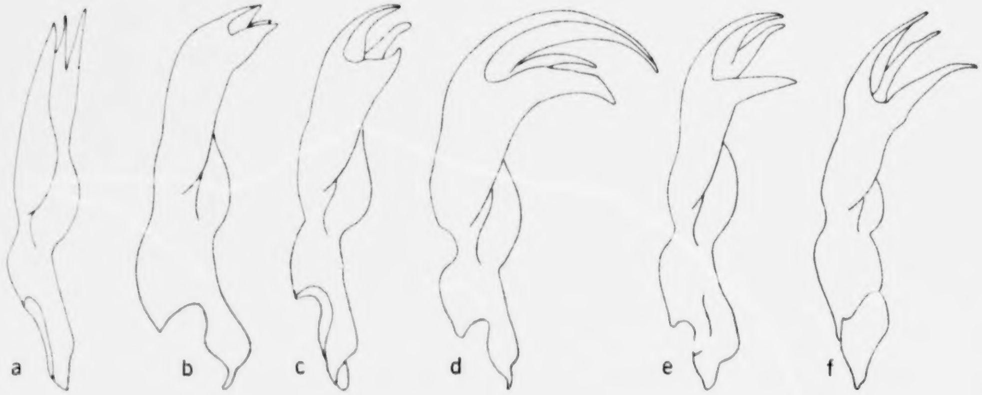

Fig. 15. Mesial view of left first pleopods. a, *Cambarellus shufeldtii*; b, *C. diminutus*; c, *C. schmitti*; d, *C. ninae*; e, *C. puer*; f, *C. alvarezi* (after Villalobos, 1955).

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3(2) Caudal process of first pleopod broadly triangular and in lateral aspect obscuring mesial process (Fig. 15b):

Cambarellus diminutus Hobbs, 1945

(Lentic and sluggish lotic habitats in Mobile County, Alabama, and George and Jackson counties, Mississippi. Literature: Hobbs, 1945b; Black, 1965)

Caudal process of first pleopod digitiform or subsetiform and in lateral aspect never obscuring mesial process (Fig. 15c-f)... 4

4(3) Mesial process of first pleopod broadly triangular, its apex curved distolaterally (Fig. 15c):

Cambarellus schmitti Hobbs, 1942

(Springs and streams from Mobile County, Alabama, eastward to the Suwannee River drainage in Florida. Literature: Hobbs, 1942b)

Mesial process comparatively slender and directed subcaudally (Fig. 15d-f)... 5

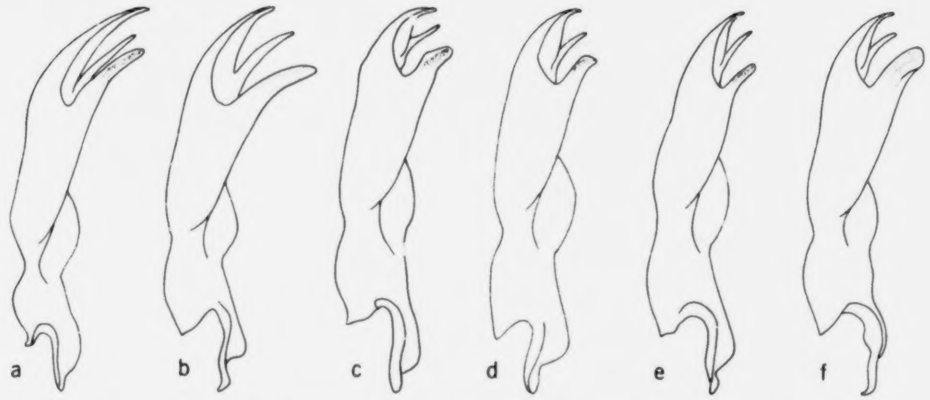

Fig. 16. Mesial view of left first pleopods. a, *Cambarellus occidentalis*; b, *C. areolatus;* c, *C. chapalanus*; d, *C. patzcuarensis*; e, *C. zempoalensis*; f, *C. montezumae.*

5(4) Central projection of first pleopod directed caudally and extending much beyond other terminal elements (Fig. 15d):

Cambarellus ninae Hobbs, 1950

(Lentic habitats in Aransas County, Texas. Literature: Hobbs, 1950)

Central projection of first pleopod directed caudodistally and not extending caudally so far as other terminal elements (Fig. 15e,f).. 6

6(5) Mesial process of first pleopod subsetiform (Fig. 15f): *Cambarellus alvarezi* Villalobos, 1952 (Lentic habitat at Potosí, Nuevo León, 23 km. northwest of Galena, México; known only from the type-locality. Literature: Villalobos, 1955)

Mesial process of first pleopod robust but subacute (Fig. 15e; see also Fig. 5c): *Cambarellus puer* Hobbs, 1945 (Lentic and sluggish lotic habitats from Brazos and Matagorda counties, Texas, to western Tennessee, Holmes County, Mississippi, and Ascension Parish, Louisiana. Literature: Penn and Hobbs, 1958; Black, 1965)

7(1) Central projection of first pleopod constituting at least 1/5 total length of appendage (Fig. 16a,b)..................... 8

Central projection of first pleopod constituting less than 1/5 total length of appendage (Fig. 16c-f).................... 9

8(7) Areola at least 3.5 times longer than broad (Fig. 17a; see also Fig. 16a): *Cambarellus occidentalis* (Faxon, 1898) (Lentic habitats in Michoacán and Sinaloa, México. Literature: Faxon, 1898; Villalobos, 1955)

Areola less than 3.5 times longer than broad (Fig. 17b); see also Fig. 16b): *Cambarellus areolatus* (Faxon, 1885) (Lotic habitats in Coahuila, México. Literature: Faxon, 1898; Villalobos, 1955)

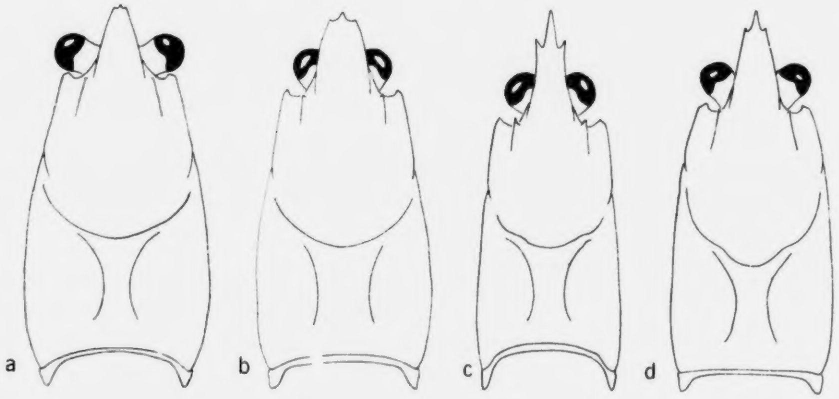

Fig. 17. Dorsal view of carapaces. a, *Cambarellus occidentalis*; b, *C. areolatus*; c, *C. chapalanus*; d. *C. patzcuarensis*.

9(7) Length of acumen of rostrum as great or greater than distance between tips of marginal spines (Fig. 17c,d)............... 10

Length of acumen of rostrum less than distance between tips of marginal spines of rostrum (Fig. 18a,b).................... 11

10(9) Acumen decidedly longer than distance between tips of marginal spines of rostrum; cephalothorax slender and gently tapering in width anteriorly (Fig. 17c; see also Fig. 16c): *Cambarellus chapalanus* (Faxon, 1898) (Lentic habitats in Jalisco and Michoacán, México. Literature: Faxon, 1898; Villalobos, 1955)

Acumen subequal to or only slightly longer than distance between marginal spines of rostrum; cephalothorax somewhat robust and rather abruptly tapering in width anteriorly (Fig. 17d; see also Fig. 16d): *Cambarellus patzcuarensis* Villalobos, 1943 (Lago de Patzcuaro, Michoacán, México. Literature: Villalobos, 1955)

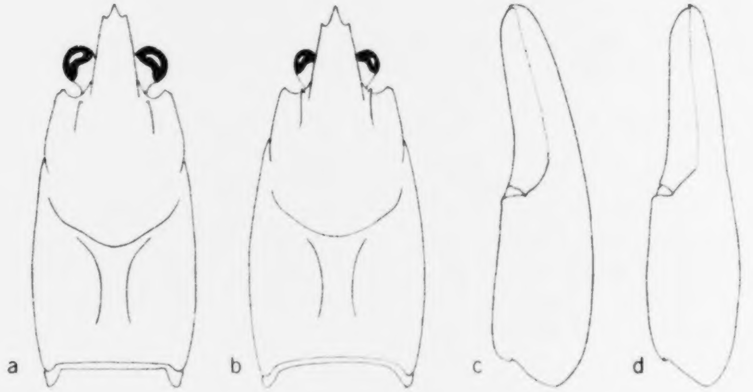

Fig. 18. a,b, Dorsal view of carapaces; c,d, Dorsal view of chelae. a, *Cambarellus zempoalensis*; b, *C. montezumae*; c, *C. zempoalensis*; d, *C. montezumae*.

11(9) Lateral margin of chela strongly convex (Fig. 18c; see also Figs 16e, 18a): *Cambarellus zempoalensis* Villalobos, 1943 (Lagunas de Zempoala, Morelos, México. Literature: Villalobos, 1955)

Lateral margin of chela not markedly convex (Fig. 18d; see also Figs 16f, 18b): *Cambarellus montezumae* (Saussure, 1858) (Sluggish streams and lentic situations in the Valley of México and Pacific slope. The subspecies *C. m. dugesii* (Faxon, 1898) and *C. m. lermensis* Villalobos, 1943, cannot be separated by me from the typical form of the species. Literature: Villalobos, 1955)

KEY TO SPECIES OF GENUS *FAXONELLA*
(Based on First-Form Male)

NOTE: Pleopods should be examined in situ in caudal aspect.

1 Mesial process of first pleopod less than 1/4 length of central projection and never overlapping mesial process of corresponding pleopod (Fig. 19c): *Faxonella clypeata* (Hay, 1899) (Sluggish streams and lentic habitats from LeFlore County, Oklahoma, and Marion County, Texas, east to Gadsden County, Florida, and Richland County, South Carolina. Literature: Fitzpatrick, 1963)

Mesial process of first pleopod greater than 1/4 length of central projection and completely overlapping mesial process of corresponding pleopod (Fig. 19a,b)...................... 2

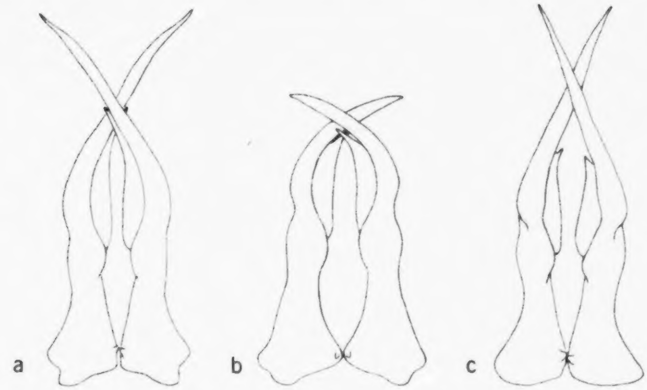

Fig. 19. Ventral view of first pleopods. a, *Faxonella creaseri*; b, *F. beyeri*; c, *F. clypeata*.

2(1) Mesial process of first pleopod distinctly greater than 1/3 length of central projection but never completely overlapping both terminal elements of corresponding pleopod (Fig. 19b): *Faxonella beyeri* (Penn, 1950) (Roadside ditches in De Soto and Natchitoches parishes, Louisiana. Literature: Fitzpatrick, 1963; Penn, 1950)

Mesial process of first pleopod about 1/3 length of central projection and always completely overlapping both terminal elements of corresponding pleopod (Fig. 19a; see also Fig. 5w): *Faxonella creaseri* Walls, 1968 (Roadside ditches in Caldwell Parish, Louisiana. Literature: Walls, 1968)

KEY TO SUBGENERA OF *PROCAMBARUS*
(Based on First-Form Male)

1 Carapace with 2 or more cervical spines (Fig. 20a)........... 2
Carapace with or without 1 cervical spine (Fig. 20b)......... 4

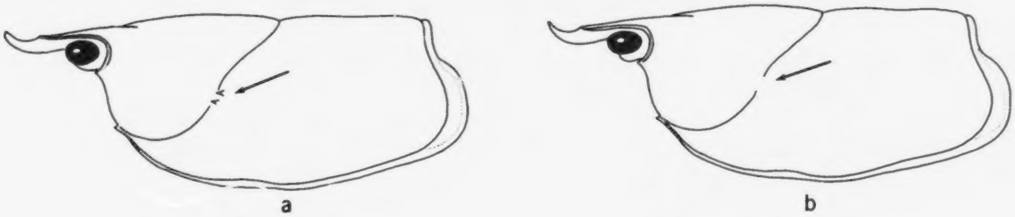

Fig. 20. Lateral view of carapaces showing presence (a) and absence (b) of cervical spines.

2(1) First pleopods asymmetrical (Like Fig. 21c,d):
Pennides Hobbs, 1972 (p. 67)
First pleopods symmetrical (Like Fig. 21a,b)................. 3

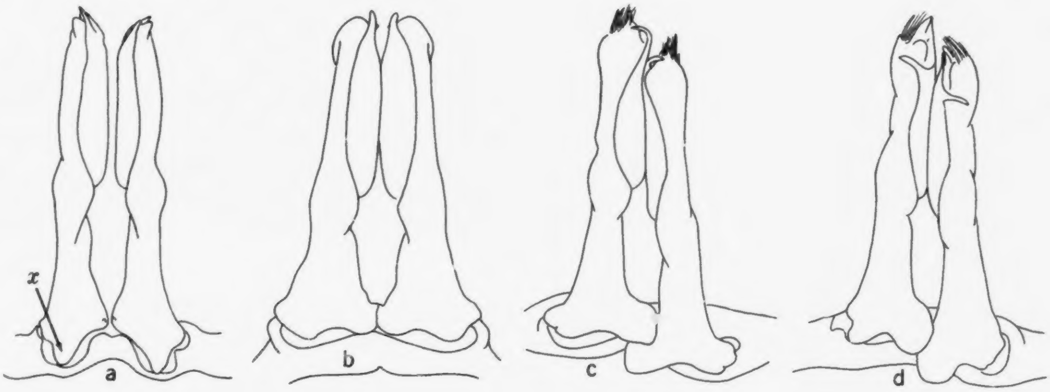

Fig. 21. Ventral view of first pleopods: a and b, symmetrical; c and d, asymmetrical. a, *Procambarus hagenianus*; b, *P. llamasi*; c, *P. seminolae*; d, *P. acutissimus*. (*x*, proximomedian lobe.)

3(2) Albinistic; eyes reduced and without pigment:
Remoticambarus Hobbs, 1972
Monotypic: *Procambarus* (*R.*) *pecki* Hobbs, 1967.
(Subterranean waters of northern Alabama. See Fig. 22b.
Literature: Hobbs, 1967)
Pigmented; eyes well developed:
Austrocambarus Hobbs, 1972 (part) (p.38)

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4(1) Cephalic surface of first pleopod with prominent angular or subangular shoulder situated far proximal to base of terminal elements (Figs 22a*s*,b,c, 30, 56) 5

Cephalic surface of first pleopod with or without prominent angular or subangular shoulder; if present, situated immediately proximal to base of terminal elements (Fig. 22d-h), or, if situated more proximally, somewhat rounded and cephalic process never broadly rounded (Figs 48f, 49h, 54a,b)....... 7

5(4) Hooks on ischia of third and fourth pereiopods (Fig. 4c); first pleopod with subapical setae (Fig. 22a): *Scapulicambarus* Hobbs, 1972 (p. 71)

Hooks on ischia of third pereiopods only (Fig. 4a); first pleopod without subapical setae (Fig. 22b,c).............. 6

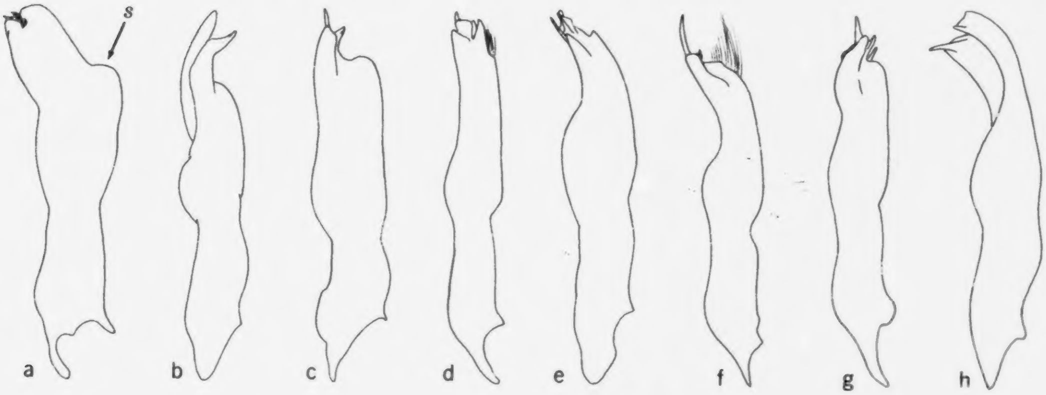

Fig. 22. Lateral view of left first pleopods. a, *Procambarus okaloosae*; b, *P. pecki*; c, *P. rodriguezi*; d, *P. fitzpatricki*; e, *P. digueti*; f, *P. latipleurum*; g, *P. s. simulans*; h, *P. tenuis*. (*s*, shoulder.)

6(5) Mesial process of first pleopod massive, obscuring entire remainder of distal portion of appendage in caudal aspect (Fig. 23a; see also Figs 11g, 22b): *Remoticambarus* Hobbs, 1972

Monotypic: *Procambarus* (*R.*) *pecki* Hobbs, 1967.
(See couplet 3 for range and literature)

Mesial process of first pleopod spiniform or lanceolate, never obscuring entire remainder of distal portion of appendage in caudal aspect (Fig. 23b): *Austrocambarus* (part) (p. 38)

7(4) Hooks on ischia of fourth pereiopods only (Fig. 4e), occasionally with vestigial ones on third pereiopods............... 8

Hooks on ischia of third or third and fourth pereiopods well developed (Fig. 4a,c,d)................................ 10

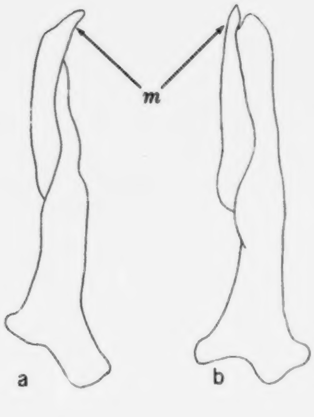

Fig. 23. Caudal view of left first pleopods. a, *Procambarus pecki*; b, *P. williamsoni*. (*m*, mesial process.)

8(7) Central projection of first pleopod beaklike and curved caudally (Fig. 24a,b): *Paracambarus* Ortmann, 1906 (p. 66)

Central projection of first pleopod never beaklike, variously directed (Figs 24c,d, 57)................................ 9

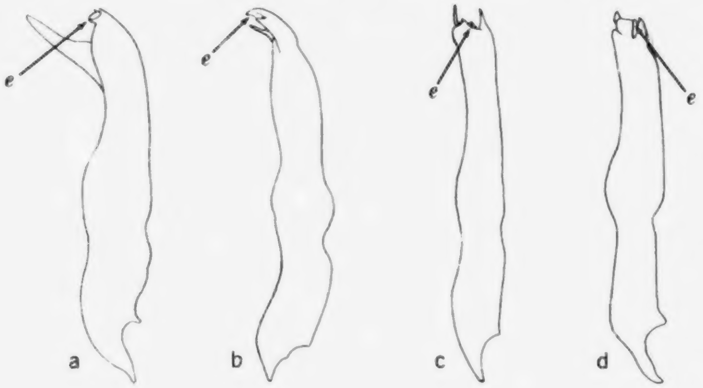

Fig. 24. Lateral view of left first pleopods. a, *Procambarus paradoxus*; b, *P. ortmanni*; c, *P. riojai*; d, *P. fitzpatricki*. (*e*, central projection.)

9(8) Mesial ramus of uropod with distomedian spine projecting beyond margin of ramus (Like Fig. 40b; see also Fig. 24d): *Acucauda* Hobbs, 1972

Monotypic: *Procambarus* (*A.*) *fitzpatricki* Hobbs, 1971. (Burrows in southern Mississippi between the Wolf and Pascagoula rivers. Literature: Hobbs, 1971a)

Mesial ramus of uropod with distomedian spine never projecting beyond margin of ramus (Like Fig. 40a): *Villalobosus* Hobbs, 1972 (p. 73)

10(7) Chela without tubercles or brush of setae on mesial surface of palm; first 3 pairs of pereiopods with conspicuous brush of plumose setae extending from basis to at least proximal part of merus (Fig. 25a): *Capillicambarus* Hobbs, 1972 (p. 44)

Chela with tubercles (Fig. 26a,c-e) (sometimes obscured by conspicuous brush of setae, Fig. 26f) on mesial surface of palm (tubercles almost obsolete in *P. youngi*); first 3 pairs of pereiopods always lacking conspicuous brush of plumose setae extending from basis to at least proximal part of merus (Fig. 25b).................................... 11

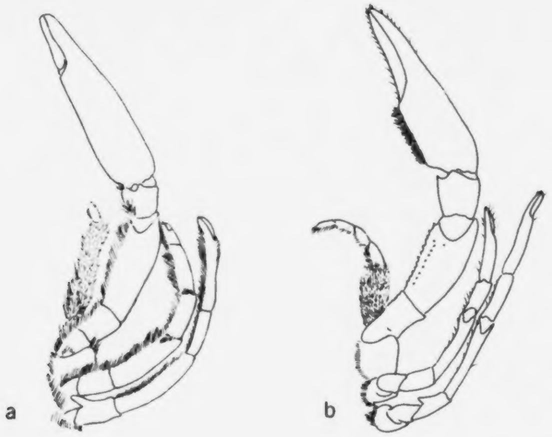

Fig. 25. Ventral view of left third maxillipeds and first three pereiopods. a, *Procambarus hinei*; b, *P. barbatus*.

11(10) Chela strongly depressed, usually broadly triangular, and with mesialmost row of tubercles on palm cristiform or subcristiform (Fig. 26a): *Hagenides* Hobbs, 1972 (p. 48)

Chela subovate to cylindrical, mostly elongate, and lacking cristiform row of tubercles on mesial margin of palm (Figs 26b-f, 38a-c)... 12

12(11) Hooks on ischia of third pereiopods only (Fig. 4a).......... 13
Hooks on ischia of third and fourth pereiopods (Fig. 4c,d).. 16

13(12) First pleopod with subapical setae (Fig. 22f):
Leconticambarus Hobbs, 1972 (part) (p. 51)
First pleopod without subapical setae (Figs 22e,g, 27a)..... 14

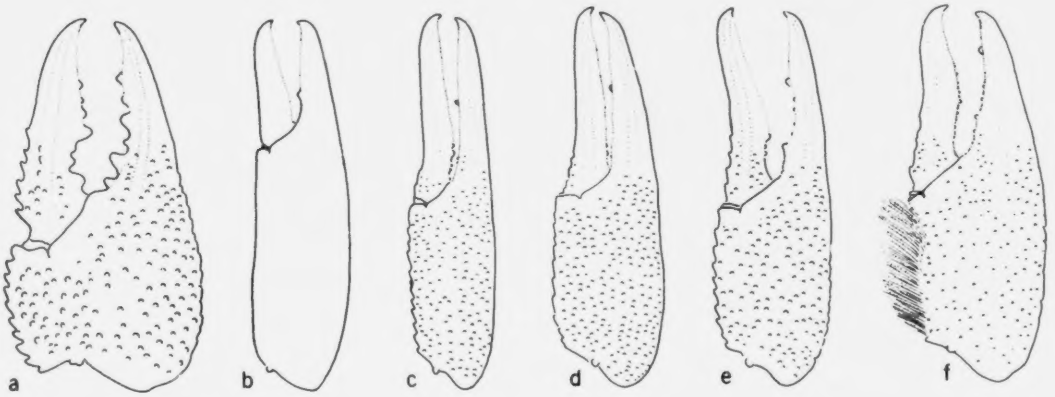

Fig. 26. Dorsal view of chelae. a, *Procambarus rogersi expletus*; b, *P. youngi*; c, *P. lecontei*; d, *P. hirsutus*; e, *P. seminolae*; f, *P. barbatus*.

14(13) Cephalic process of first pleopod forming curved plate across cephalodistal extremity of appendage (Fig. 27a):
Mexicambarus Hobbs, 1972
Monotypic: *Procambarus* (*M.*) *bouvieri* (Ortmann, 1909). (Streams in the vicinity of Uruapan, Michoacán, México. Literature: Villalobos, 1955)
Cephalic process of first pleopod variable in form but never consisting of curved plate across cephalodistal extremity of appendage (Fig. 22e,g)..............................15

15(14) Rostrum with median carina (Fig. 28a*k*); first pleopod with proximomedian lobe absent (Like Fig. 21b; see also Figs 6a, 22e): *Procambarus* Ortmann, 1905
Monotypic: *Procambarus* (*P.*) *digueti* (Bouvier, 1897). (Streams in Jalisco and Michoacán, México. Literature: Villalobos, 1955)
Rostrum without median carina (Like Fig. 28b); first pleopod with proximomedian lobe very strongly developed (Fig. 21a*x*):
Girardiella Lyle, 1938 (p. 45)

16(12) Bituberculate hooks on ischia of third and fourth pereiopods (Fig. 4d; see also Fig. 11d); albinistic:
Lonnbergius Hobbs, 1972
Monotypic: *Procambarus* (*L.*) *acherontis* (Lonnberg, 1895). (Subterranean waters and springs in Seminole County, Florida. Literature: Hobbs, 1942b)
Bituberculate hooks never on ischia of both third and fourth pereiopods; albinistic or pigmented.................. 17

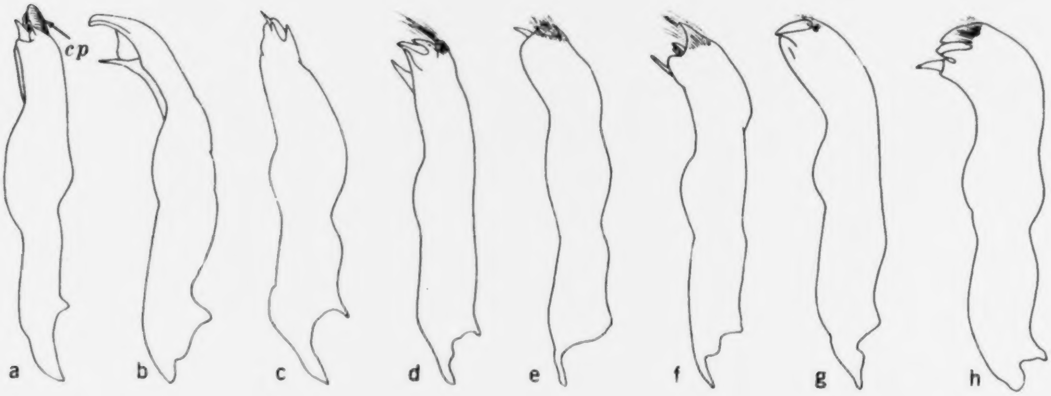

Fig. 27. Lateral view of left first pleopods. a, *Procambarus bouvieri*; b, *P. tenuis*; c, *P. lewisi*; d, *P. a. acutus*; e, *P. fallax*; f, *P. pictus*; g, *P. planirostris*; h, *P. p. pearsei* (*cp*, cephalic process.)

17(16) First pleopod without subapical setae (Fig. 27b,c)........ 18
First pleopod with subapical setae (Figs 27d-h, 29c-f).... 19

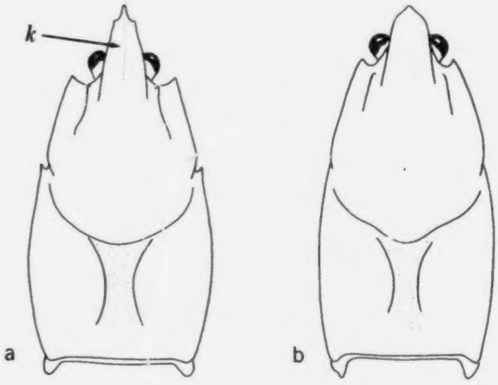

Fig. 28. Dorsal view of carapaces. a, *Procambarus digueti*; b, *P. rathbunae*. (*k*, median carina.)

18(17) First pleopod with central projection very conspicuous and extending distally far beyond cephalic and mesial processes; cephalic process situated distinctly mesial to base of central projection (Fig. 27b): *Tenuicambarus* Hobbs, 1972
Monotypic: *Procambarus* (*T.*) *tenuis* Hobbs, 1950.
(Stream tributaries of the Red and Ouachita rivers in south-eastern Oklahoma and western Arkansas. Literature: Williams, 1954a; Hobbs, 1962)

First pleopod with central projection not conspicuously large and never extending distally far beyond cephalic and mesial processes; cephalic process, if present, either cephalic or lateral to central projection (Figs 27c, 47c, 48f):
Ortmannicus Fowler, 1912 (part) (p. 54)

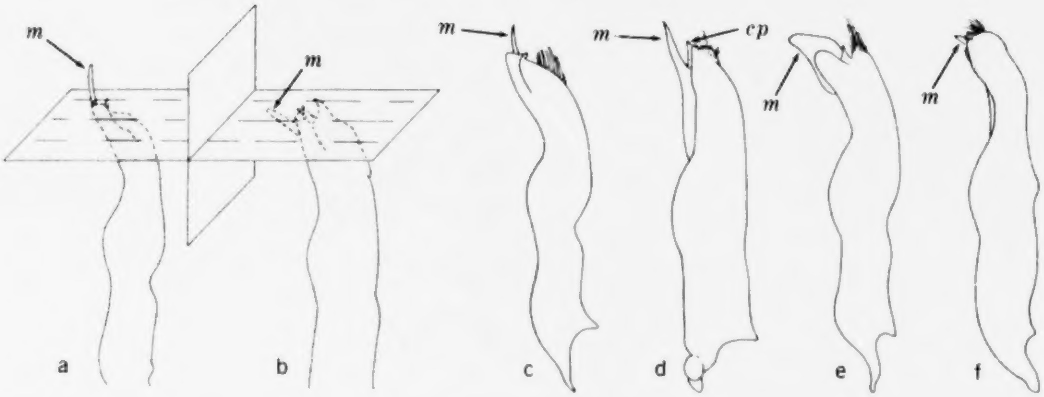

Fig. 29. Lateral view of left first pleopods. a, *Procambarus latipleurum*; b, *P. litosternum*; c, *P. barbatus*; d, *P. villalobosi*; e, *P. kilbyi*; f, *P. hubbelli*. (*cp*, cephalic process; *m*, mesial process.)

19(17) Mesial process of first pleopod usually extending to or beyond apical plane *perpendicular to axis* of shaft of appendage (Fig. 29a); if not (Fig. 29f), mesial surface of palm of chela bearded (Fig. 26f):
Lecontiicambarus (part) (p. 51)

Mesial process of first pleopod seldom extending to or beyond apical plane perpendicular to axis of shaft of appendage (Fig. 29b); if so, cephalic process situated caudomesial to central projection (Fig. 29d) or subapical setae situated lateral to base of cephalic process (Fig. 27e,f); mesial surface of palm of chela never bearded (Fig. 26b-e):
Ortmannicus (part) (p. 54)

Key to Species of Subgenus *Austrocambarus*

1 First pleopod with prominent bulbous enlargement between level of shoulder and base of central projection (Fig. 30a-c, *x*). 2

First pleopod lacking bulbous enlargement (slightly developed in *P. williamsoni*) between level of shoulder and base of central projection (Fig. 30d-g)........................ 5

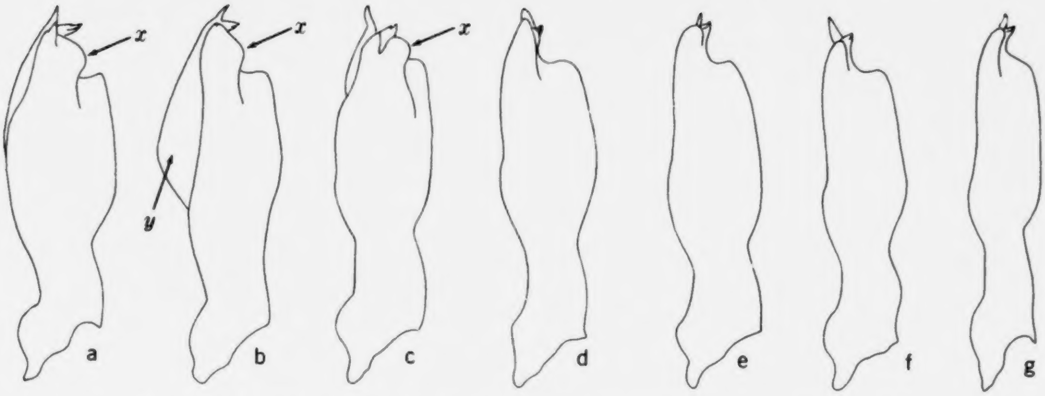

Fig. 30. Lateral view of left first pleopods. a, *Procambarus cubensis rivalis*; b, *P. c. cubensis*; c, *P. atkinsoni*; d, *P. williamsoni*; e, *P. aztecus*; f, *P. mexicanus*; g, *P. r. ruthveni*. (*x*, see couplet 1; *y*, see couplet 3.)

2(1) Albinistic, eyes reduced but with small pigmented area:
Procambarus (*A.*) *niveus* Hobbs and Villalobos, 1964
(Subterranean waters of Cuevas de Santo Tomás, Sierra de los Organos, near Ponce, Pinar del Río, Cuba. Literature: Hobbs and Villalobos, 1964)

Pigmented, eyes well developed............................ 3

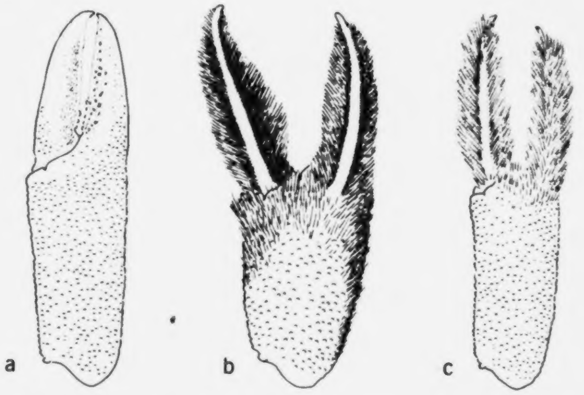

Fig. 31. Dorsal view of chelae. a, *Procambarus williamsoni*; b, *P. pilosimanus*; c, *P. llamasi*.

3(2) Areola almost always more than 4 times longer than broad and constituting at least 26 per cent of total length of carapace; mesial (inner) part of first pleopod expanded caudally much more than lateral (outer) part (Fig. 30b, *y*): *Procambarus* (*A.*) *cubensis cubensis* (Erichson, 1846) (Various types of freshwater habitats throughout the island of Cuba, except in the southwestern mountains, and Isla de Pinos. Literature: Hobbs and Villalobos, 1964)

Areola usually less than 4 times longer than broad and seldom constituting as much as 26 per cent of total length of carapace; mesial (inner) part of first pleopod expanded little if any more than lateral (outer) part (Fig. 30a,c) 4

4(3) Shoulder on cephalic surface of first pleopod rounded or tuberculiform; middle part of shaft with cephalic and caudal margins subparallel (Fig. 30c): *Procambarus* (*A.*) *atkinsoni* (Ortmann, 1913) (Streams on Isla de Pinos, Cuba. Literature: Hobbs and Villalobos, 1964)

Shoulder on cephalic surface of first pleopod angular; middle part of shaft of first pleopod with cephalic and caudal margins convex (Fig. 30a): *Procambarus* (*A.*) *cubensis rivalis* (Faxon, 1912) (Streams in the province of Pinar del Río, Cuba. Literature: Hobbs and Villalobos, 1964)

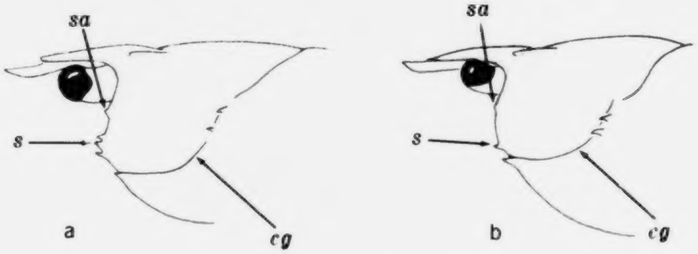

Fig. 32. Lateral view of carapaces. a, *Procambarus acanthophorus*; b, *P. pilosimanus*. (*cg*, cervical groove; *s*, spine; *sa*, suborbital angle.)

5(1) Carapace with 2 or more cervical spines (Fig. 20a).......... 6

Carapace with or without 1 cervical spine (Fig. 20b)........ 9

6(5) Chela not conspicuously pubescent (Fig. 31a); cephalic margin of hepatic region of carapace usually without spines, never more than 1, between cervical groove (*cg*) and suborbital angle (*sa*) (Like Fig. 32b; see also Figs 23b, 30d): *Procambarus* (*A.*) *williamsoni* (Ortmann, 1905) (Lentic habitats in the province of Izabal, Guatemala, and Lago Yojoa, Honduras. Literature: Ortmann, 1905b)

Chela with fingers conspicuously pubescent (Fig. 31b,c); cephalic margin of hepatic region of carapace with 1 or more spines between cervical groove (*cg*) and suborbital angle (*sa*) (Fig. 32a,b)................................ 7

7(6) Chela with conspicuous long pubescence largely confined to fingers (Fig. 31c; see also Fig. 21b): *Procambarus* (*A.*) *llamasi* Villalobos, 1954 (Small streams and drainage ditches from Veracruz to Yucatán, México, and northern Guatemala. Literature: Villalobos, 1955)

Chela with conspicuous long pubescence both on fingers and much of palm (Fig. 31b)................................ 8

8(7) Cephalic margin of hepatic region of carapace with 3 or 4 spines between cervical groove and suborbital angle (Fig. 32a); tip of hook on ischium of third pereiopod not extending proximad of basioischial articulation (*bi*) (Fig. 33b): *Procambarus* (*A.*) *acanthophorus* Villalobos, 1948 (Streams and canals in Atlantic drainage in Oaxaca and southern Veracruz, México. Literature: Villalobos, 1955)

Cephalic margin of hepatic region of carapace with only 1 spine between cervical groove and suborbital angle (Fig. 32b); tip of hook on ischium of third pereiopod extending proximad of basioischial articulation (Fig. 33a; see also Fig. 31b): *Procambarus* (*A.*) *pilosimanus* (Ortmann, 1906) (Lentic habitats from Chiapas and Quintana Roo, México, to British Honduras and Guatemala. Literature: Villalobos, 1955)

9(5) Albinistic; eyes reduced but with small pigment spot (See also Fig. 22c): *Procambarus* (*A.*) *rodriguezi* Hobbs, 1943 (Subterranean stream, Cueva de Ojo de Agua, west-northwest of hacienda Potrero Viejo, Paraje Nuevo, Córdoba, Veracruz, México. Literature: Villalobos, 1955)

Pigmented; eyes well developed............................ 10

10(9) Areola less than 7 times longer than broad with 3 or 4 punctations across narrowest part (Fig. 34a):
Procambarus (*A.*) *mirandai* Villalobos, 1954
(Subterranean stream, Cerro Hueco, 4 km. southeast of Tuxtla Gutiérrez, Chiapas, México. Literature: Villalobos, 1955)

Areola at least 9 times longer than broad with 1 or 2 punctations across narrowest part (Fig. 34b-d)............... 11

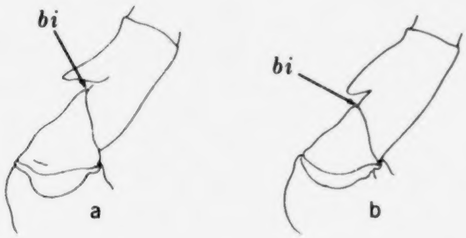

Fig. 33. Caudoventral view of basal portions of third pereiopods; a, *Procambarus pilosimanus*; b, *P. acanthophorus*. (*bi*, basioischial articulation.)

11(10) Caudodistal margin of central projection of first pleopod with small subacute projection near midlength (Fig. 35a); eyes conspicuously large (Fig. 34b):
Procambarus (*A.*) *vazquezae* Villalobos, 1954
(Rocky shore of Laguna de Catemaco, Veracruz, México. Literature: Villalobos, 1955)

Caudodistal margin of central projection of first pleopod evenly contoured (Fig. 35b); eyes not conspicuously large (Fig. 34c,d).. 12

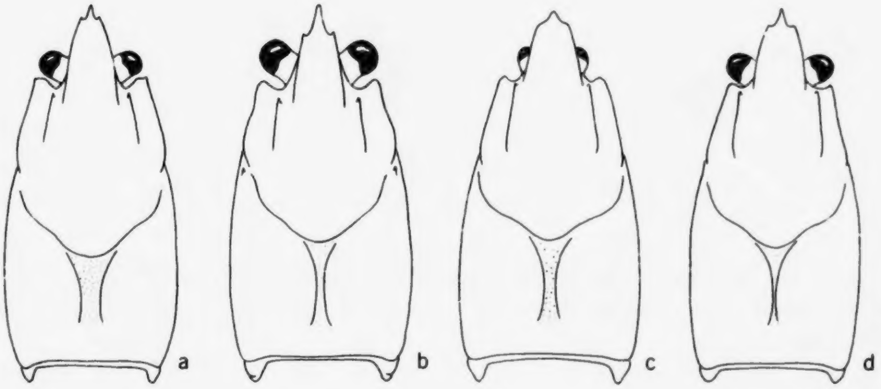

Fig. 34. Dorsal view of carapaces. a, *Procambarus mirandai*; b, *P. vazquezae*; c, *P. aztecus*; d, *P. veracruzanus*.

12(11) Distal margin of shoulder on cephalic surface of first pleopod sloping proximally from base (Fig. 30g)................. 13

Distal margin of shoulder on cephalic surface of first pleopod perpendicular to shaft or concave proximad (Fig. 30e,f). 14

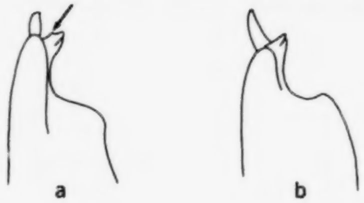

Fig. 35. Lateral view of distal portion of first pleopods. a, *Procambarus vazquezae*; b, *P. mexicanus*.

13(12) Hook on ischiopodite of third pereiopod extending proximally beyond basioischial articulation (Like Fig. 33a):

Procambarus (*A.*) *ruthveni zapoapensis* Villalobos, 1954 (Streams in the vicinity of Catemaco, Veracruz, México. Literature: Villalobos, 1955)

Hook on ischiopodite of third pereiopod never extending proximally beyond basioischial articulation (Like Fig. 33b; see also Fig. 30g):

Procambarus (*A.*) *ruthveni ruthveni* (Pearse, 1911) (Temporary lentic habitats and burrows in the vicinity of Cuatotolapan, Veracruz, México. Literature: Villalobos, 1955)

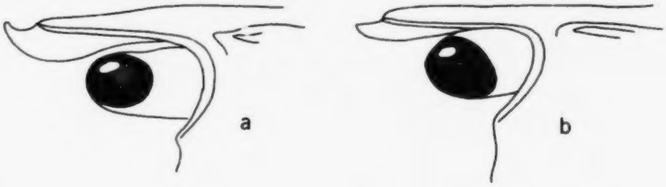

Fig. 36. Lateral view of rostral region: a, *Procambarus mexicanus*; b, *P. aztecus*.

14(12) Areola very narrow, sublinear, with room for at most 1 punctation in narrowest part (Fig. 34d):
Procambarus (*A.*) *veracruzanus* Villalobos, 1954
(Stream at Presidio, 30 km. southeast of Córdoba, Veracruz, México. Literature: Villalobos, 1955)

Areola not sublinear, with room for at least 2 punctations in narrowest part (Fig. 34c)............................... 15

15(14) Acumen of rostrum upturned apically (Fig. 36a; see also Figs 30f, 35b): *Procambarus* (*A.*) *mexicanus* (Erichson, 1846)
(Reported from a single locality, El Mirador de Zacuapan, 8 km. northeast of Huatusco, Veracruz, México. Literature: Villalobos, 1955)

Acumen of rostrum straight, never distinctly upturned (Fig. 36b; see also Figs 30e, 34c):
Procambarus (*A.*) *aztecus* (Saussure, 1857)
(Streams in the vicinity of Jalapa, Veracruz, México. Literature: Villalobos, 1955)

Key to Species of Subgenus *Capillicambarus*

1 Distal 1/3 of first pleopod tapering, ending in 2 subacute tips and third small subtruncate one (Fig. 37a; see also Fig. 25a): *Procambarus* (*C.*) *hinei* (Ortmann, 1905)
(Lentic habitats in southeastern Texas and southern Louisiana. Literature: Penn, 1953a)

Distal 1/3 of first pleopod almost uniformly broad, ending in 2 distinct tips, one of which broadly truncate (Fig. 37b): *Procambarus* (*C.*) *incilis* Penn, 1962
(Lentic habitats in southeastern Texas - Jackson, Matagorda, and Wharton counties. Literature: Penn, 1962)

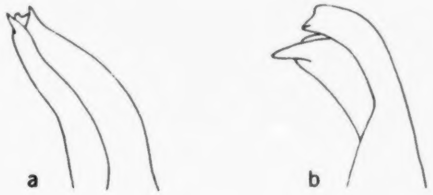

Fig. 37. Lateral view of distal portions of left first pleopods. a, *Procambarus hinei*; b, *P. incilis*.

Key to Species of Subgenus *Girardiella*

1 Mesial surface of palm of chela bearded (Fig. 38a); areola with 3 or 4 punctations across narrowest part (Fig. 38d; see also Fig. 39e): *Procambarus* (*G.*) *tulanei* Penn, 1953 (Lentic and lotic habitats and burrows between the Red and Ouachita river systems in Louisiana and Arkansas. Literature: Penn, 1956b, 1959)

Mesial surface of palm of chela never bearded (Fig. 38b,c); areola linear or with only 1 or 2 punctations across narrowest part (Fig. 38e)................................... 2

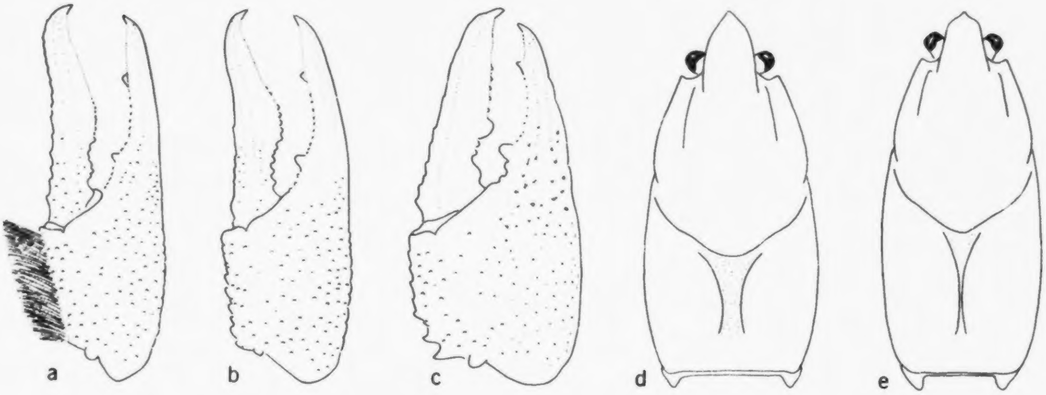

Fig. 38. a-c, Dorsal view of chelae; d,e, Dorsal view of carapaces. a, *Procambarus tulanei*; b, *P. s. simulans*; c, *P. gracilis*; d, *P. tulanei*; e, *P. gracilis*.

2(1) Areola with room for more than 1 punctation across narrowest part; chela with length of inner margin of palm subequal to or greater than width of palm (Fig. 38b).............. 3

Areola linear, never with room for more than 1 punctation across narrowest part (Fig. 38e); chela with length of inner margin of palm less than width of palm (Fig. 38c)......... 4

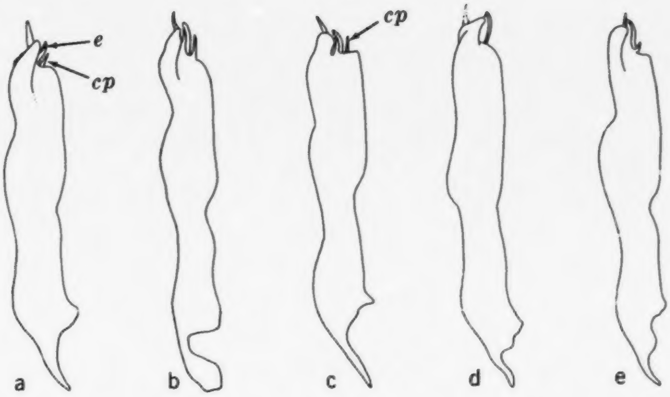

Fig. 39. Lateral view of left first pleopods. a, *Procambarus s. simulans*; b, *P. s. regiomontanus*; c, *P. gracilis*; d, *P. hagenianus*; e, *P. tulanei*. (*cp*, cephalic process; *e*, central projection.)

3(2) Central projection (*e*) and cephalic process (*cp*) of first pleopod tilted cephalodistally; caudal margin of main body of appendage evenly contoured (Fig. 39a; see also Fig. 38b): *Procambarus* (*G.*) *simulans simulans* (Faxon, 1884) (Lentic and lotic habitats from New Mexico to Colorado, Kansas, Arkansas, and Louisiana. A species complex that has been investigated by Rollin D. Reimer. Publication of his revision of the species is anticipated in the near future. Literature: Williams, 1954a)

Central projection and cephalic process of first pleopod directed distally (Fig. 39b); caudal margin of main body of appendage sometimes with angular notch near base of distal 1/3:

Procambarus (*G.*) *simulans regiomontanus* Villalobos, 1954 (Known only from the type-locality, 5 km. north of Monterrey, Nuevo León, México. Literature: Villalobos, 1955)

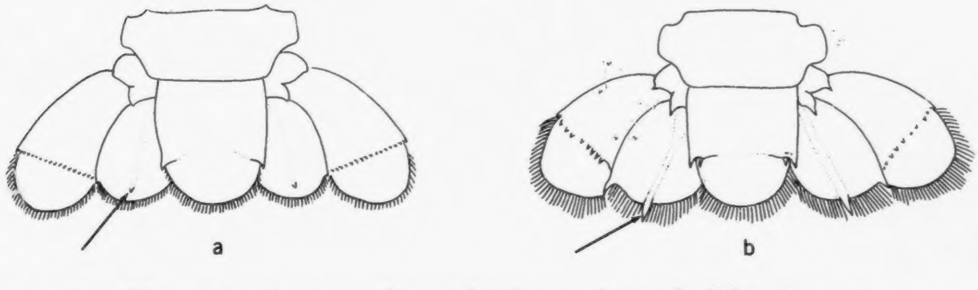

Fig. 40. Dorsal view of terminal portion of abdomens. a, *Procambarus gracilis*; b, *P. hagenianus*. (Arrow indicating median spine on inner ramus of uropod.)

4(2) Cephalic process (*cp*) of first pleopod well developed (Fig. 39c); inner ramus of uropod with median spine not projecting distally beyond margin of ramus (Fig. 40a; see also Fig. 38c,e): *Procambarus* (*G.*) *gracilis* (Bundy, 1876) (Burrows in Texas, Oklahoma, Kansas, Arkansas, Missouri, Iowa, Illinois, and Wisconsin. A species complex that has been investigated by Rollin D. Reimer. Publication of his revision of the species is anticipated in the near future. Literature: Williams, 1954a)

Cephalic process of first pleopod absent (Fig. 39d); inner ramus of uropod with median spine projecting distally much beyond margin of ramus (Fig. 40b; see also Fig. 21a): *Procambarus* (*G.*) *hagenianus* (Faxon, 1884) (Burrows in central and eastern Mississippi and western Alabama. A species complex that is being revised by Joseph F. Fitzpatrick. Literature: Faxon, 1885, 1914)

Key to Species of Subgenus *Hagenides*

1 Central projection (*e*) of first pleopod platelike and directed laterally across cephalodistal surface of pleopod (Fig. 41a). 2

Central projection (*e*) of first pleopod beaklike and directed caudally, distally, or caudodistally (Fig. 41b-e).......... 5

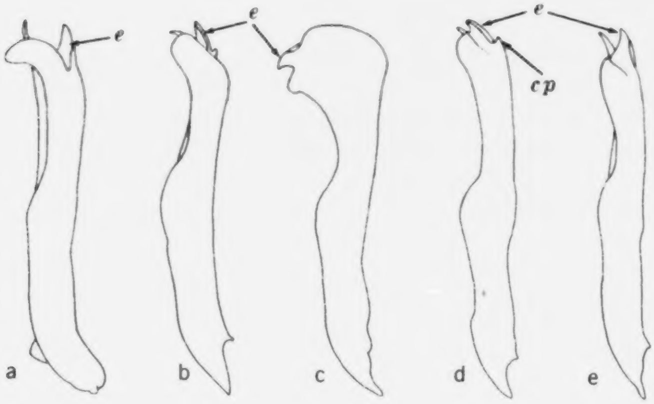

Fig. 41. Lateral view of left first pleopods. a, *Procambarus r. rogersi*; b, *P. geodytes*; c, *P. truculentus*; d, *P. advena*; e, *P. pygmaeus*. (*cp*, cephalic process; *e*, central projection.)

2(1) Caudal knob (*ck*) of first pleopod directed mesially at approximately right angle to principal axis of shaft of appendage (Fig. 42a; see also Fig. 41a):
Procambarus (*H.*) *rogersi rogersi* (Hobbs, 1938)
(Burrows in eastern Calhoun County, Florida. Literature, Hobbs, 1945a)

Caudal knob (*ck*) of first pleopod directed distolaterally at angle less than 90 degrees to principal axis of shaft of appendage (Fig. 42b-d).................................. 3

3(2) Cephalic process (*cp*) of first pleopod extending as far distally as central projection (Fig. 42b; see also Fig. 26a):
Procambarus (*H.*) *rogersi expletus* Hobbs and Hart, 1959
(Known only from the type-locality, burrows 0.9 mile north of Clarksville, Calhoun County, Florida. Literature: Hobbs and Hart, 1959)

Cephalic process of first pleopod not extending so far distally as central projection (Fig. 42c,d)....................... 4

4(3) Caudal knob of first pleopod in caudal aspect, distinctly fingerlike, longer than broad (Fig. 42c):
Procambarus (*H.*) *rogersi campestris* Hobbs, 1942
(Burrows in Leon and Wakulla counties, Florida. Literature: Hobbs, 1945a)

Caudal knob of first pleopod in caudal aspect, thumblike, almost or quite as broad as long (Fig. 42d):
Procambarus (*H.*) *rogersi ochlocknensis* Hobbs, 1942
(Burrows in Gadsden and Liberty counties, Florida. Literature: Hobbs, 1945a)

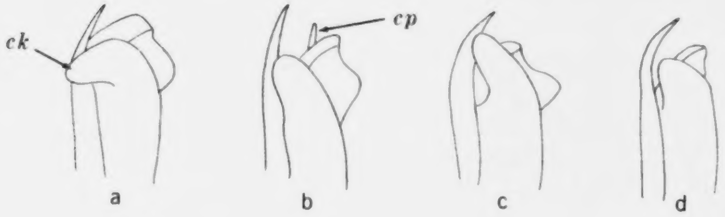

Fig. 42. Caudal view of distal portion of left first pleopods. a, *Procambarus r. rogersi*; b, *P. r. expletus*; c, *P. r. campestris*; d, *P. r. ochlocknensis*. (*ck*, caudal knob; *cp*, cephalic process.)

5(1) Ischia of third and fourth pereiopods with hooks (Fig. 4c; see also Fig. 41b): *Procambarus* (*H.*) *geodytes* Hobbs, 1942
(Burrows along the St. John's River and its tributaries from Putnam County south to Orange County, Florida. Literature: Hobbs, 1942b)

Ischia of only third pereiopods with hooks (Fig. 4a)......... 6

6(5) Central projection (*e*) and mesial process of first pleopod directed caudally at angle of 90 degrees to axis of main shaft of appendage (Fig. 41c):
Procambarus (*H.*) *truculentus* Hobbs, 1954
(Burrows between the Savannah and Altamaha rivers in Georgia. Literature: Hobbs, 1954)

Central projection (*e*) and mesial process of first pleopod directed caudodistally at angle much less than 90 degrees (Fig. 41d,e)... 7

7(6) Cephalic process (*cp*) of first pleopod moderately well-developed to rudimentary (Fig. 41d):
Procambarus (*H.*) *advena* (LeConte, 1856)
(Burrows in the lower coastal plain between the Savannah River, Georgia, and Alachua County, Florida. Literature: Hobbs, 1942b)

Cephalic process of first pleopod totally absent (Fig. 41e):
Procambarus (*H.*) *pygmaeus* Hobbs, 1942
(Lentic and lotic habitats and burrows in southeastern Georgia and in Gulf, Liberty, Leon, and Wakulla counties, Florida. Literature: Hobbs, 1942b)

Key to Species of Subgenus *Leconticambarus*

1 Albinistic; eyes with reduced pigment (See also Fig. 11f): *Procambarus* (*L.*) *milleri* Hobbs, 1971 (Subterranean waters in Dade County, Florida. Literature: Hobbs, 1971c)

Pigmented; eyes normally pigmented.......................... 2

2(1) Hooks on ischia of third pereiopods only (Fig. 4a)........... 3

Hooks on ischia of third and fourth pereiopods (Fig. 4c)..... 6

3(2) Mesial process (*m*) of first pleopod massive and subspatulate (Fig. 43f): *Procambarus* (*L.*) *kilbyi* (Hobbs, 1940) (Burrows and lentic habitats in Calhoun and Gulf counties east and south to Levy County, Florida. Literature: Hobbs, 1942b)

Mesial process of first pleopod slender and tapering to acute or subacute apex (Figs 43a-e,g,h, 44a-d).................. 4

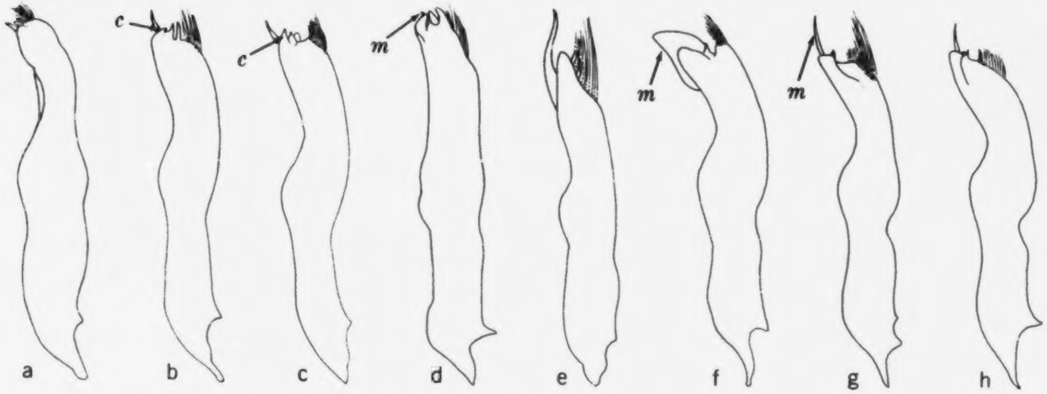

Fig. 43. Lateral view of left first pleopods. a, *Procambarus hubbelli;* b, *P. rathbunae;* c, *P. capillatus;* d, *P. shermani;* e, *P. alleni;* f, *P. kilbyi;* g, *P. latipleurum;* h, *P. barbatus.* (*c*, caudal process; *m*, mesial process.)

4(3) First pleopod with mesial process extending no farther distally than cephalic process; subapical setae in apical cluster (Fig. 43a): *Procambarus* (*L.*) *hubbelli* (Hobbs, 1940) (Burrows and lentic habitats in the Choctawhatchee River basin in Alabama and Florida. Literature: Hobbs, 1942b)

First pleopod with mesial process extending much farther distally than cephalic process; subapical setae arranged in linear series on cephalodistal margin of appendage (Fig. 43b,c).. 5

5(4) First pleopod with caudal process (*c*) directed cephalodistally, not reaching level of tips of cephalic process and central projection (Fig. 43b; see also Fig. 28b):
Procambarus (*L.*) *rathbunae* (Hobbs, 1940)
(Burrows and lentic habitats in Okaloosa and Holmes counties, Florida. Literature: Hobbs, 1942b)

First pleopod with caudal process (*c*) directed distally and extending at least to level of tips of cephalic process and central projection (Fig. 43c):
Procambarus (*L.*) *capillatus* Hobbs, 1971
(Burrows and lentic habitats in the Escambia River basin in Alabama and Florida. Literature: Hobbs, 1971b)

6(2) First pleopod with mesial process (*m*) reaching no farther distally than tip of cephalic process (Fig. 43d):
Procambarus (*L.*) *shermani* Hobbs, 1942
(Streams and sloughs in Pearl River County, Mississippi, St. Tammany Parish, Louisiana, and in the Escambia River drainage, Florida. Literature: Hobbs, 1942b)

First pleopod with mesial process reaching much farther distally than tip of cephalic process (Figs 43e-h, 44a-d).......... 7

7(6) First pleopod with mesial process sinuous (Fig. 43e):
Procambarus (*L.*) *alleni* (Faxon, 1884)
(Lentic and lotic habitats east of the St. John's River and all of peninsular Florida south of Levy and Marion counties. Literature: Hobbs, 1942b)

First pleopod with mesial process straight or curved but never sinuous (Figs 43f-h, 44a-d).............................. 8

8(7) First pleopod with mesial process massive, subspatulate, and its apex directed almost caudally (Fig. 43f):
Procambarus (*L.*) *kilbyi* (Hobbs, 1940)
(See couplet 3 for range and literature)

First pleopod with mesial process acute to subspiculiform, and its apex directed caudo- or cephalodistally (Figs 43g,h, 44a-d).. 9

9(8) First pleopod with mesial process directed distally or cephalodistally (Figs 43g,h, 44a)....................... 10

First pleopod with mesial process directed caudodistally (Fig. 44b-d).. 12

10(9) Palm of chela of male not bearded (Fig. 44e; see also Fig. 43g):
Procambarus (*L.*) *latipleurum* Hobbs, 1942
(Burrows and lentic habitats in Gulf County, Florida. Literature: Hobbs, 1942b)

Palm of chela of male bearded (Fig. 44f)....................11

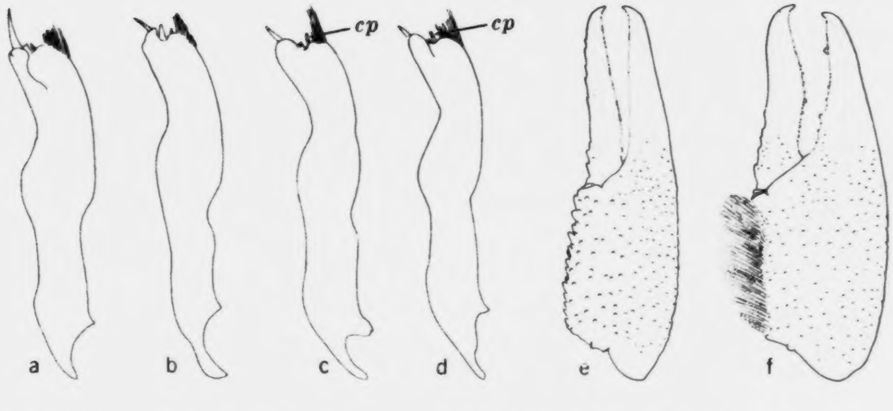

Fig. 44. a-d, Lateral view of left first pleopods; e,f, Dorsal view of chelae. a, *Procambarus pubischelae*; b, *P. escambiensis*; c, *P. econfinae*; d, *P. apalachicolae*; e, *P. latipleurum*; f, *P. barbatus*. (*cp*, cephalic process.)

11(10) First pleopod with cephalodistal margin sloping steeply from base of cephalic process (Fig. 43h; see also Figs 25b, 44f): *Procambarus* (*L.*) *barbatus* (Faxon, 1890)
(Burrows and lentic habitats in the coastal plain between the Edisto River in South Carolina and the Altamaha River in Georgia. Literature: Faxon, 1890; Hobbs, 1942b)
First pleopod with cephalodistal margin forming rounded hump (Fig. 44a): *Procambarus* (*L.*) *pubischelae* Hobbs, 1942
(Burrows and lentic habitats from the Altamaha River, Georgia, southward to Alachua County, Florida. Literature: Hobbs, 1942b)

12(9) Palm of chela of male bearded (Like Fig. 44f; also see Fig. 44b): *Procambarus* (*L.*) *escambiensis* Hobbs, 1942
(Burrows and lentic habitats in the lower Perdido and Escambia river basins in Alabama and Florida. Literature: Hobbs, 1942b)
Palm of chela of male not bearded (Like Fig. 44e)............ 13

13(12) First pleopod with cephalic process (*c*) curved, its apex directed cephalodistally (Fig. 44c): *Procambarus* (*L.*) *econfinae* Hobbs, 1942
(Burrows and lentic habitats in Bay County, Florida. Literature: Hobbs, 1942b)
First pleopod with cephalic process (*c*) straight and directed caudodistally (Fig. 44d): *Procambarus* (*L.*) *apalachicolae* Hobbs, 1942
(Burrows and lentic habitats in Bay County and Gulf counties, Florida. Literature: Hobbs, 1942b)

Key to Species of Subgenus *Ortmannicus*

1 Albinistic.. 2
Pigmented.. 4

2(1) Eye with small black pigment spot (See also Fig. 45a):
Procambarus (*O.*) *lucifugus alachua* (Hobbs, 1940)
(Subterranean habitats in western Gilchrist and southwestern Alachua counties, Florida. Intergrades with the nominate subspecies in Marion County, Florida. Literature: Hobbs, 1942b, 1958c)
Eye without pigment.. 3

3(2) Distal portion of first pleopod bent caudally at 60 to 80 degrees, and cephalic process directed at angle of approximately 70 degrees, to main axis of appendage (Fig. 45b):
Procambarus (*O.*) *lucifugus lucifugus* (Hobbs, 1940)
(Subterranean habitats from Citrus and Hernando counties northward to Marion County, Florida, where it intergrades with *P. lucifugus alachua*. Literature: Hobbs, 1942b, 1958c)
Distal portion of first pleopod bent caudally at no more than 45 degrees, and cephalic process directed at angle of approximately 35 degrees, to main axis of appendage (Fig. 45c; see also Fig. 9b): *Procambarus* (*O.*) *pallidus* (Hobbs, 1940)
(Subterranean habitats from Suwannee County to northwestern Alachua County, Florida. Literature: Hobbs, 1942b, 1962)

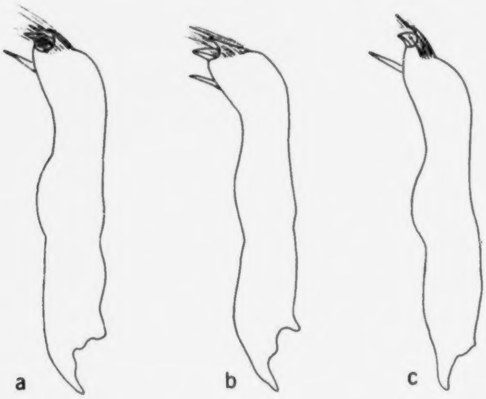

Fig. 45. Lateral view of left first pleopods. a, *Procambarus lucifugus alachua*; b, *P. l. lucifugus*; c, *P. pallidus*.

4(1) Subapical setae borne on knob on cephalodistal or laterodistal surface of first pleopod (Figs 46a-h, 47a)................. 5
Subapical setae, if present, never borne on distinct knob (Figs 47b-h, 48, 49, 50).................................... 13

5(4) Setiferous knob situated on cephalodistal surface of first pleopod with broad gap between it and cephalic process (Fig. 46a): *Procambarus* (*O.*) *viaeviridis* (Faxon, 1914) (Sluggish streams and lentic habitats from Clay and Greene counties, Arkansas, to Tuscaloosa County, Alabama. Literature: Faxon, 1914; Hobbs, 1962)

Setiferous knob of first pleopod usually laterally situated; if cephalic to cephalic process never widely separated from it (Figs 46b-h, 47a).. 6

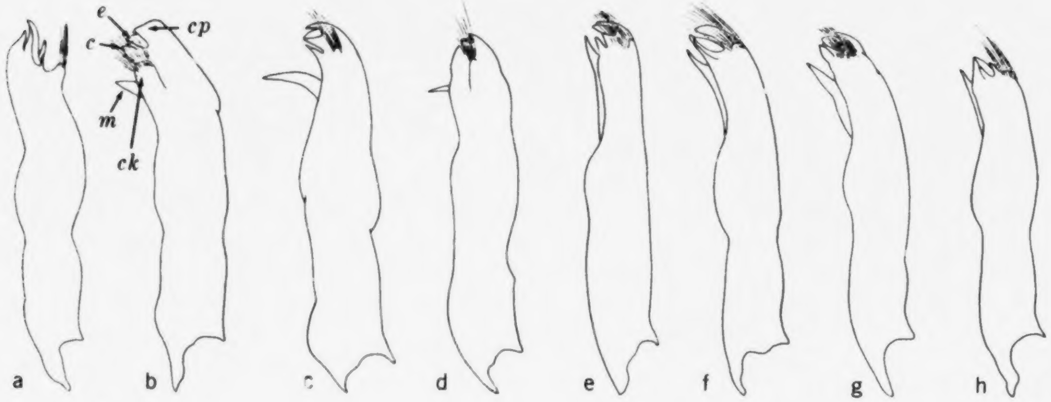

Fig. 46. Lateral view of left first pleopods. a, *Procambarus viaeviridis*; b, *P. hayi*; c, *P. lecontei*; d, *P. acutissimus*; e, *P. texanus*; f, *P. acutus cuevachicae*; g, *P. lophotus*; h, *P. blandingii*. (*ck*, caudal knob: *cp*, cephalic process; *e*, central projection; *m*, mesial process; *c*, caudal process.)

6(5) Setiferous knob situated at lateral base of caudal process of first pleopod (Fig. 46b): *Procambarus* (*O.*) *hayi* (Faxon, 1884) (Lentic and sluggish lotic habitats in the Tombigbee and Tallahatchie river systems in Mississippi and Alabama, and in the Hatchie drainage system in Tennessee. Literature: Faxon, 1885; Hobbs, 1962)

Caudal knob of first pleopod situated cephalically or laterally but never so far caudally as at base of caudal process (Figs 46c-h, 47a)... 7

7(6) Mesial process of first pleopod directed at 90 degree angle to main axis of appendage (Fig. 46c,d)...................... 8

Mesial process of first pleopod directed at angle less than 90 degrees to main axis of appendage (Figs 46e-h, 47a)....... 9

8(7) Cephalic process and central projection of first pleopod directed caudally at 90 degree angle to main axis of appendage (Fig. 46c; see also Fig. 26c):
Procambarus (*O.*) *lecontei* (Hagen, 1870)
(Streams in Stone County, Mississippi, and Mobile County, Alabama. Literature: Hobbs, 1952a)

Cephalic process and central projection of first pleopod directed caudodistally at angle much less than 90 degrees to main axis of appendage (Fig. 46d; see also Fig. 21d):
Procambarus (*O.*) *acutissimus* (Girard, 1852)
(Lentic habitats in the Tombigbee, Alabama, and Choctawhatchee drainages in east central Mississippi and west central Alabama. Literature: Hobbs, 1962)

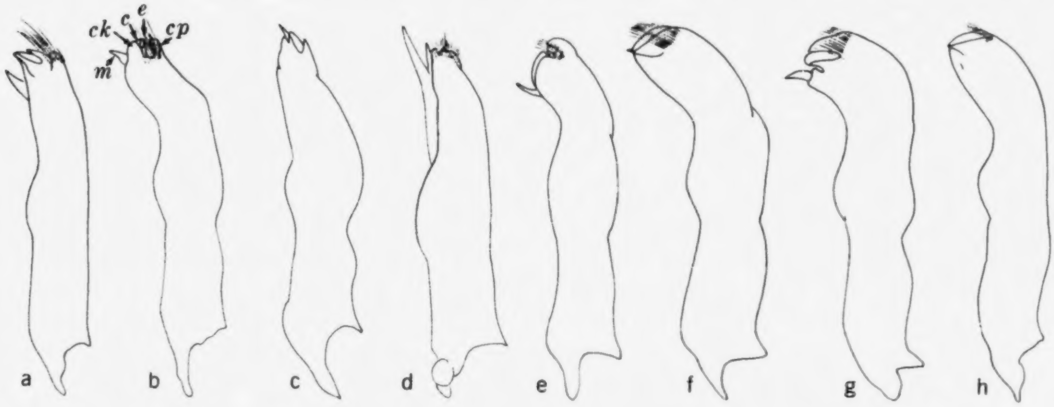

Fig. 47. Lateral view of left first pleopods. a, *Procambarus a. acutus*; b, *P. bivittatus*; c, *P. lewisi*; d, *P. villalobosi*; e, *P. gonopodocristatus*; f, *P. mancus*; g, *P. p. pearsei*; h, *P. planirostris*. (*c*, caudal process; *ck*, caudal knob; *cp*, cephalic process; *e*, central projection; *m*, mesial process.)

9(7) Prominent gap between caudal process and central projection of first pleopod (Fig. 46e):
Procambarus (*O.*) *texanus* Hobbs, 1971
(Lentic and sluggish lotic habitats in Bastrop County, Texas. Literature: Hobbs, 1971b)

Gap between caudal process and central projection of first pleopod exceedingly narrow (Figs 46f-h, 47a)........... 10

10(9) Cephalic process of first pleopod bladelike and rounded distally (Fig. 46f):
Procambarus (*O.*) *acutus cuevachicae* (Hobbs, 1941)
(Subterranean and lentic habitats in San Luis Potosí and Puebla, México. Literature: Villalobos, 1959)

Cephalic process of first pleopod tapering and acute (Figs 46g,h, 47a)..11

11(10) Caudal process of first pleopod lanceolate in lateral aspect (Fig. 46g): *Procambarus (O.) lophotus* Hobbs and Walton, 1960 (Lentic and lotic habitats in tributaries of the Alabama River from Clarke County, Alabama, to Gordon and Catoosa counties, Georgia, and in the Tennessee drainage in Polk County, Tennessee, and northwestern Georgia. Literature: Hobbs and Walton, 1960; Hobbs, 1962)

Caudal process of first pleopod tapering from base in lateral aspect (Figs 46h, 47a).................................. 12

12(11) First pleopod with setiferous knob situated at extreme cephalic base of cephalic process; setae not obscuring part of central projection in lateral aspect (Fig. 46h):
Procambarus (O.) blandingii (Harlan, 1830)
(Lentic and lotic habitats from the Pee Dee River system to the Santee system in southern North Carolina and in South Carolina. Literature: Faxon, 1885; Hobbs, 1962)

First pleopod with setiferous knob situated cephalolateral to cephalic process; setae obscuring at least proximal 1/2 of central projection in lateral aspect (Fig. 47a):
Procambarus (O.) acutus acutus (Girard, 1852)
(Sluggish to moderately flowing streams and lentic habitats in the coastal plain and piedmont from Maine to Georgia, from Minnesota to Ohio, and from the Florida panhandle to Texas; intergrades with *P. a. cuevachicae* in Texas and northern México. Literature: Hobbs, 1962)

13(4) First pleopod with subapical setae absent (Figs 47c, 48f)... 14

First pleopod with subapical setae present (Figs 47b,d-h, 48a-e,g,h, 49,50)...................................... 15

14(13) Cephalic process of first pleopod directed distally (Fig. 47c; see also Fig. 51b):
Procambarus (O.) lewisi Hobbs and Walton, 1959
(Sluggish lotic and lentic habitats between the Alabama and Chattahoochee rivers in southeastern Alabama. Literature: Hobbs and Walton, 1959; Hobbs, 1962)

Cephalic process of first pleopod directed caudally (Fig. 48f):
Procambarus (O.) hybus Hobbs and Walton, 1957
(Lentic habitats and burrows in the Tombigbee River drainage in Alabama and Mississippi. Literature: Hobbs and Walton, 1957; Hobbs, 1962)

15(13) Caudal knob of first pleopod distinct and extending distally to approximately same level as caudal process and central projection (Fig. 47b; see also Fig. 51a);

Procambarus (*O.*) *bivittatus* Hobbs, 1942 (Streams from the Pearl River drainage in Louisiana to the Escambia River drainage in Santa Rosa County, Florida. Literature : Hobbs, 1942b)

Caudal knob of first pleopod, if distinct, directed caudodistally, never extending to approximately same level as caudal process and central projection (Figs 47d-h, 48a-e, g,h, 49, 50) 16

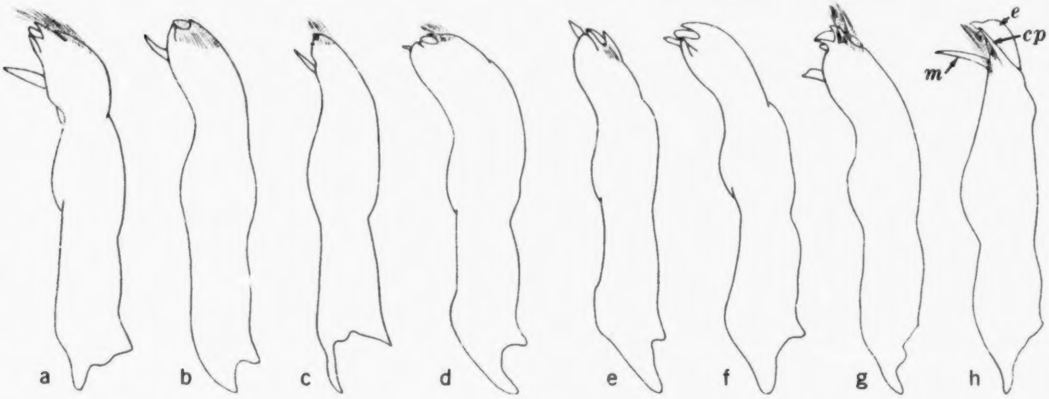

Fig. 48. Lateral view of left first pleopods. a, *Procambarus verrucosus*; b, *P. evermanni*; c, *P. caballeroi*; d, *P. pearsei plumimanus*; e, *P. jaculus*; f, *P. hybus*; g, *P. lepidodactylus*; h, *P. toltecae*. (*c*, cephalic process; *e*, central projection; *m*, mesial process.)

16(15) Caudal process of first pleopod prominent, usually compressed laterally, and arising from caudolateral surface of pleopod; caudal knob never well-defined; cephalic process absent, or if present, arising from cephalic or cephalomesial side of central projection (Figs 47d-h, 48a-e).... 17

Caudal process of first pleopod seldom prominent, sometimes absent, if present, arising distinctly mesial to caudal knob except in *P. lepidodactylus* and *P. toltecae* in which cephalic process situated lateral to central projection; cephalic process arising from cephalic or lateral side of central projection (Figs 48g,h, 49, 50) 26

17(16) Cephalic process of first pleopod situated on mesial surface of appendage and directed distally (Fig. 47d):
Procambarus (*O.*) *villalobosi* Hobbs, 1969
(Stream in Cueva del Agua, 75 km. east of Valles, San Luis Potosí, México. Literature: Hobbs, 1969a)
Cephalic process of first pleopod absent, or situated cephalic or cephalomesial to central projection (Figs 47e-h, 48a-e).. 18

18(17) Caudal process of first pleopod forming long bladelike arc along distal caudolateral surface of appendage (Fig. 47e):
Procambarus (*O.*) *gonopodocristatus* Villalobos, 1958
(Lentic habitats in northern Veracruz, México. Literature: Villalobos, 1959)
Caudal process of first pleopod never forming long bladelike arc along distal caudolateral surface of appendage (Figs 47f-h, 48a-e)... 19

19(18) Cephalic process of first pleopod absent (Fig. 47f):
Procambarus (*O.*) *mancus* Hobbs and Walton, 1957
(Lentic habitats and burrows in Lauderdale and Newton counties, Mississippi. Literature: Hobbs and Walton, 1957; Hobbs, 1962)
Cephalic process of first pleopod present (Figs 47g,h, 48a-e).. 20

20(19) Central projection of first pleopod directed caudally at 90 degree angle to main axis of appendage (Fig. 47g,h)...... 21
Central projection of first pleopod never directed caudally so much as at 90 degree angle to main axis of appendage (Fig. 48a-e).. 22

21(20) All terminal elements of first pleopod directed caudad at 90 degree angle to main axis of appendage, and cephalic process extending as far caudad as caudal process (Fig. 47g):
Procambarus (*O.*) *pearsei pearsei* (Creaser, 1934)
(Lentic habitats and burrows from Cumberland County, North Carolina, southward to Horry County, South Carolina. Apparently intergrading with *P. pearsei plumimanus* in Johnston and Pitt counties, North Carolina. Literature: Creaser, 1934b; Hobbs, 1962)
Mesial process of first pleopod directed caudodistally and cephalic process never extending so far caudad as caudal process (Fig. 47h):
Procambarus (*O.*) *planirostris* Penn, 1953
("Florida" parishes of southeastern Louisiana and Pearl River and Winston counties, Mississippi. Literature: Penn, 1953b; Hobbs, 1962)

22(20) Rostrum with marginal spines or tubercles, or at least angulate at base of acumen (Fig. 51c)........................ 23

Rostrum with acumen not distinctly delimited basally (Fig. 51d) 24

23(22) Cephalodistal surface of first pleopod with long rounded hump extending proximally from base of cephalic process and with subapical setae restricted to area cephalic to base of cephalic process (Fig. 48a; see also Fig. 51c):

Procambarus (*O.*) *verrucosus* Hobbs, 1952

(Stream tributaries of the Tallapoosa and Chattahoochee rivers in southeastern Alabama. Literature: Hobbs, 1952a, 1962)

Cephalodistal surface of first pleopod not produced in long rounded hump; subapical setae present also at lateral bases of cephalic process and central projection (Fig. 48b):

Procambarus (*O.*) *evermanni* (Faxon, 1890)

(Sluggish streams and lentic habitats from Jackson County, Mississippi, to Santa Rosa County, Florida. Literature: Hobbs, 1942b)

24(22) Caudal process of first pleopod acute (Fig. 48c):

Procambarus (*O.*) *caballeroi* Villalobos, 1944

(Streams south of Villa Juárez, Puebla, México. Known only from area of the type-locality. Literature: Villalobos, 1959)

Caudal process of first pleopod rounded or truncate (Fig. 48d, e).. 25

25(24) Mesial process of first pleopod gently tapering and directed caudally; cephalic process situated cephalomesial to central projection; caudal process subtruncate (Fig. 48d):

Procambarus (*O.*) *pearsei plumimanus* Hobbs and Walton, 1958

(Lentic habitats and burrows in Carteret, Craven, and Duplin counties, North Carolina. Literature: Hobbs and Walton, 1958; Hobbs, 1962)

Mesial process of first pleopod lanceolate and directed caudodistally; cephalic process situated cephalic to central projection; caudal process rounded apically (Fig. 48e; see also Fig. 51d):

Procambarus (*O.*) *jaculus* Hobbs and Walton, 1957

(Lentic habitats and burrows in Avoyelles Parish, Louisiana, and in Hinds, Rankin, and Scott counties, Mississippi. Literature: Hobbs and Walton, 1957; Hobbs, 1962)

26(16) Cephalic process of first pleopod situated distinctly lateral to central projection (Fig. 48g,h)......................27

Cephalic process of first pleopod situated cephalic to central projection (Figs 49,50)................................ 28

27(26) Rostrum with marginal spines; first pleopod with subapical setae distributed from caudal base of cephalic process to cephalic margin of pleopod (Fig. 48g):

Procambarus (*O.*) *lepidodactylus* Hobbs, 1947

(Streams in the Pee Dee and Santee drainage systems in eastern South Carolina and Columbus County, North Carolina. Literature: Hobbs, 1947b, 1958c)

Rostrum without marginal spines; first pleopod with subapical setae situated in cluster caudoproximal to cephalic process (Fig. 48h):

Procambarus (*O.*) *toltecae* Hobbs, 1943

(Lotic subterranean and epigean habitats in southern Tamaulipas and southeastern San Luis Potosí, México. Literature: Villalobos, 1959)

28(26) Caudal process of first pleopod absent or not evident in lateral aspect (Fig. 49a-g)........................... 29

Caudal process of first pleopod small to large, always evident in lateral aspect (Figs 49h, 50).............. 36

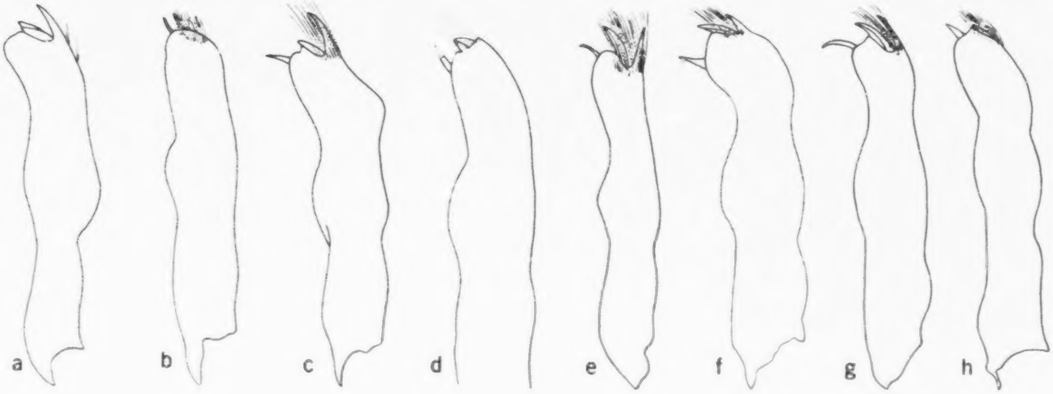

Fig. 49. Lateral view of left first pleopods. a, *Procambarus youngi*; b, *P. pycnogonopodus*; c, *P. hirsutus*; d, *P. angustatus*; e, *P. seminolae*; f, *P. lunzi*; g, *P. ancylus*; h, *P. fallax*.

29(28) First pleopod with subapical setae very few in number and restricted to cephalodistal margin at base of cephalic process (Fig. 49a); acumen as long as remainder of rostrum (see also Fig. 26b):

Procambarus (*O.*) *youngi* Hobbs, 1942

(Streams in Leon, Gulf, and Wakulla counties, Florida. Literature: Hobbs, 1942b, 1962)

First pleopod with subapical setae abundant and dispersed distally along cephalic and lateral surface of appendage (Fig. 49b-g); acumen, if distinct, much shorter than remainder of rostrum................................. 30

30(29) Central projection of first pleopod minute, much less conspicuous than other terminal elements (Fig. 49b):

Procambarus (*O.*) *pycnogonopodus* Hobbs, 1942

(Lentic and lotic habitats from the Choctawhatchee River eastward to the Apalachicola River in Florida. Literature: Hobbs, 1942b)

Central projection of first pleopod always conspicuous, frequently as large as other terminal elements (Fig. 49c-g) 31

31(30) Areola never more than 4 times as long as broad........... 32

Areola always more than 4 times as long as broad.......... 33

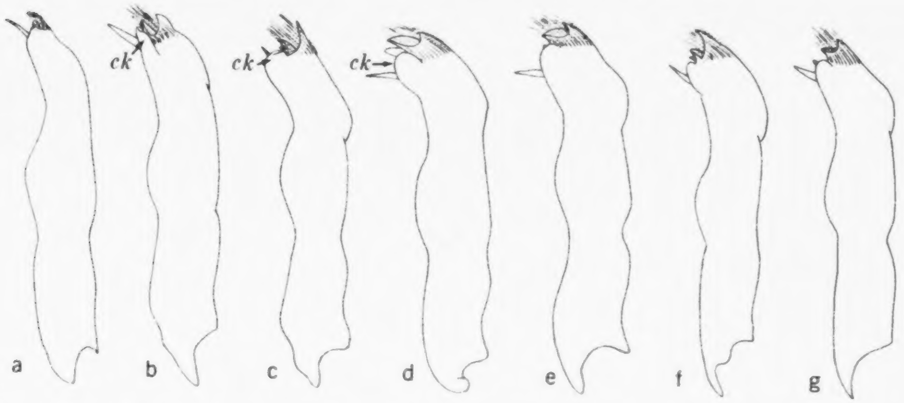

Fig. 50. Lateral view of left first pleopods. a, *Procambarus leonensis*; b, *P. litosternum*; c, *P. pubescens*; d, *P. epicyrtus*; e, *P. enoplosternum*; f, *P. pictus*; g, *P. chacei*. (*ck*, caudal knob.)

32(31) Mesial process of first pleopod much longer than central projection (Fig. 49c; see also Fig. 26d):

Procambarus (*O.*) *hirsutus* Hobbs, 1958

(Streams in the Edisto, Salkehatchie, and Savannah drainage systems in South Carolina. Literature: Hobbs, 1958a, 1958c)

Mesial process of first pleopod shorter than central projection (Fig. 49d):

Procambarus (*O.*) *angustatus* (LeConte, 1856)

(Streams in "Georgia inferiore". Known only from the single type-specimen. Literature: LeConte, 1856; Hobbs, 1962)

33(31) Cephalic process of first pleopod directed distally or cephalodistally (Fig. 49e; see also Fig. 26e):
Procambarus (*O.*) *seminolae* Hobbs, 1942
(Lentic and lotic habitats from the Altamaha River drainage, Georgia, to Marion County, Florida. Literature: Hobbs, 1942b, 1958c)

Cephalic process of first pleopod directed caudodistally (Figs 49f,g, 50a)..34

34(33) Central projection of first pleopod toothlike, almost straight, and distinctly shorter than cephalic process (Fig. 50a):
Procambarus (*O.*) *leonensis* Hobbs, 1942
(Lentic and lotic habitats between the Apalachicola and Suwannee rivers, Florida. Literature: Hobbs, 1942b)

Central projection of first pleopod somewhat bladelike, curved, and as long as cephalic process (Fig. 49f,g)............ 35

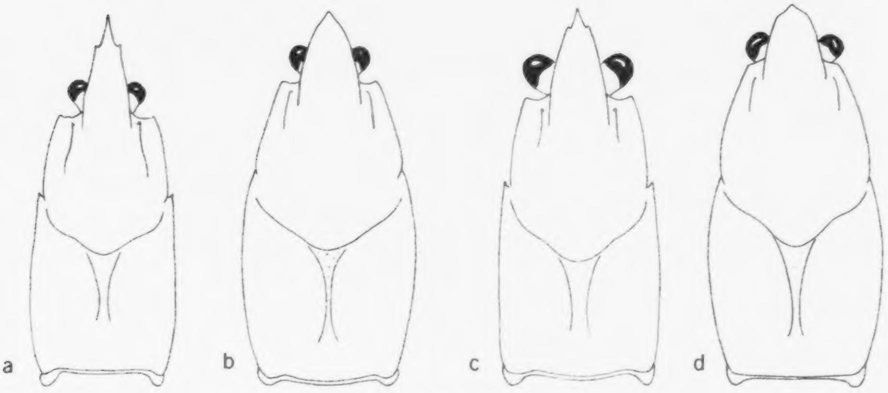

Fig. 51. Dorsal view of carapaces. a, *Procambarus bivittatus*; b, *P. lewisi*; c, *P. verrucosus*; d, *P. jaculus*.

35(34) Laterodistal margin of first pleopod at base of central projection almost horizontal; central projection directed caudally (Fig. 49f): *Procambarus* (*O.*) *lunzi* (Hobbs, 1940)
(Lentic and sluggish lotic habitats and burrows between the Combahee River, South Carolina, and Altamaha River, Georgia. Literature: Hobbs, 1940, 1958c)

Laterodistal margin of first pleopod at base of central projection steeply oblique; central projection directed caudodistally (Fig. 49g): *Procambarus* (*O.*) *ancylus* Hobbs, 1958
(Lentic and lotic habitats and burrows from Columbus, Bladen, and Brunswick counties, North Carolina, southward to Richland and Colleton counties, South Carolina. Literature: Hobbs, 1958a, 1958c)

36(28) Caudal knob (*ck*) of first pleopod well defined (Fig. 50b-g); areola usually less than 5 times longer than broad...... 38

Caudal knob of first pleopod not well defined (Figs 49h, 50a); areola usually more than 5 times longer than broad...... 37

37(36) Mesial process of first pleopod lanceolate; caudal process situated lateral to central projection (Fig. 49h): *Procambarus* (*O.*) *fallax* (Hagen, 1870)

(Lentic and lotic habitats from the Satilla River drainage, Georgia, southward through peninsular Florida. Literature: Hobbs, 1942b)

Mesial process of first pleopod subspiculiform; caudal process situated caudal to central projection (Fig. 50a): *Procambarus* (*O.*) *leonensis* Hobbs, 1942

(See couplet 34 for range and literature)

38(36) Caudal knob of first pleopod with troughlike groove cephalically (Fig. 50b): *Procambarus* (*O.*) *litosternum* Hobbs, 1947

(Stream tributaries of the Canoochee, Ogeechee, and Newport rivers in southeastern Georgia. Literature: Hobbs, 1947a, 1958c)

Caudal knob of first pleopod inflated or truncate but never with troughlike groove cephalically (Fig. 50c-g)........ 39

39(38) Caudal knob of first pleopod truncate and somewhat compressed (Fig. 50c): *Procambarus* (*O.*) *pubescens* (Faxon, 1884)

(Streams from the Oconee to the Savannah drainage systems in Georgia and South Carolina. Literature: Hobbs, 1947a, 1962)

Caudal knob of first pleopod inflated (Fig. 50d-g)......... 40

40(39) Cephalic process of first pleopod much shorter than central projection (Fig. 50d,e)............................... 41

Cephalic process of first pleopod as long as central projection (Fig. 50f,g)................................. 42

41(40) Caudal process of first pleopod in lateral aspect projecting caudally between central projection and caudal knob, filling interval between them (Fig. 50d): *Procambarus* (*O.*) *epicyrtus* Hobbs, 1958

(Stream tributaries of the Oconee and Ogeechee rivers in Georgia. Literature: Hobbs, 1958b, 1958c)

Caudal process of first pleopod in lateral aspect projecting caudally from level of caudal knob (Fig. 50e): *Procambarus* (*O.*) *enoplosternum* Hobbs, 1947

(Streams from the lower Oconee and Ohoopee river drainages in Georgia. Literature: Hobbs, 1947a, 1958c)

42(40) Caudal process of first pleopod in lateral aspect projecting caudally between central projection and caudal knob, filling interval between them (Fig. 50f):

Procambarus (*O.*) *pictus* (Hobbs, 1940)

(Streams in Clay County, Florida. Literature: Hobbs, 1942b, 1962)

Caudal process of first pleopod in lateral aspect projecting caudally from level of caudal knob (Fig. 50g):

Procambarus (*O.*) *chacei* Hobbs, 1958

(Streams from the Wateree River system, South Carolina, to the Canoochee River, Georgia. Literature: Hobbs, 1958b, 1958c)

Key to Species of Subgenus *Paracambarus*

1 Mesial process of first pleopod much larger than central projection and extending caudodistad much beyond it (Fig. 52a): *Procambarus* (*P.*) *paradoxus* (Ortmann, 1906) (Tributaries of Río Tecoluta at Tetela de Ocampo y La Cañada, 35 km. northeast of Zacapoaxtla, Puebla, México. Literature: Villalobos, 1955)

Mesial process of first pleopod much smaller than central projection and not extending so far distad as central projection (Fig. 52b): *Procambarus* (*P.*) *ortmanni* (Villalobos, 1949) (Tributary of Río San Marcos (to Río Cazones), 6 km. northeast of Zihuateutla, Puebla, México. Literature: Villalobos, 1955)

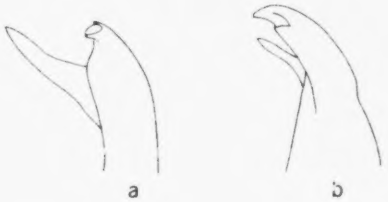

Fig. 52. Lateral view of left first pleopods. a, *Procambarus paradoxus*; b, *P. ortmanni*.

Key to Species of Subgenus *Pennides*

1 Basis of cheliped with spine on mesial surface (Fig. 53a; see also Fig. 54a): *Procambarus* (*P.*) *versutus* (Hagen, 1870) (Streams from western Alabama to the Apalachicola River in Florida. Literature: Hobbs, 1942b):
Basis of cheliped without spine on mesial surface (Fig. 53b).. 2

2(1) First pleopod with distinct angular shoulder on cephalic surface (Fig. 54b):
Procambarus (*P.*) *lylei* Fitzpatrick and Hobbs, 1971 (Tributaries of the Yalobusha River in Calhoun County, Mississippi. Literature: Fitzpatrick and Hobbs, 1971)
First pleopod without distinct angular shoulder on cephalic surface (Figs. 54c-i, 55)............................... 3

3(2) Cephalic process of first pleopod well developed (Figs 54c-i, 55a,b).. 4
Cephalic process of first pleopod absent or rudimentary (Fig. 55c-g).. 11

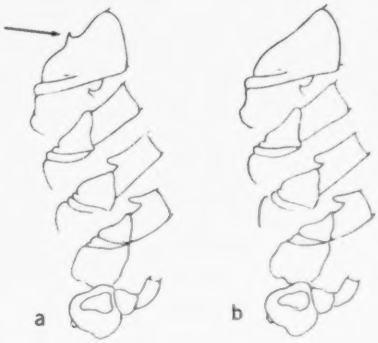

Fig. 53. Ventral view of basal portion of left pereiopods. a, Arrow indicating spine on basis of first pereiopod (cheliped); b, First pereiopod lacking spine on basis.

4(3) Cephalic process of first pleopod situated entirely mesial to central projection and completely obscured by latter in lateral aspect (Fig. 54c,d):
Procambarus (*P.*) *suttkusi* Hobbs, 1953 (Tributaries of the Choctawhatchee River in Alabama and Florida. Literature: Hobbs, 1953b, 1962)
Cephalic process of first pleopod situated cephalic, lateral, or cephalomesial to central projection, never entirely obscured by latter in lateral aspect (Figs 54e-i, 55a,b).. 5

5(4) Cephalic process of first pleopod subtruncate with acute angle caudodistally (Fig. 54e): *Procambarus* (*P.*) *vioscai* Penn, 1946 (Tributaries of the Red River in Arkansas and Louisiana eastward to the Pascagoula River in Mississippi. Literature: Penn, 1959; Hobbs, 1962)

Cephalic process of first pleopod tapering from base (Figs 54f-i, 55a,b) 6

6(5) Cephalic process of first pleopod directed caudodistally (Fig. 54h,i) 7

Cephalic process of first pleopod directed distally (Figs 54f,g, 55a,b) 8

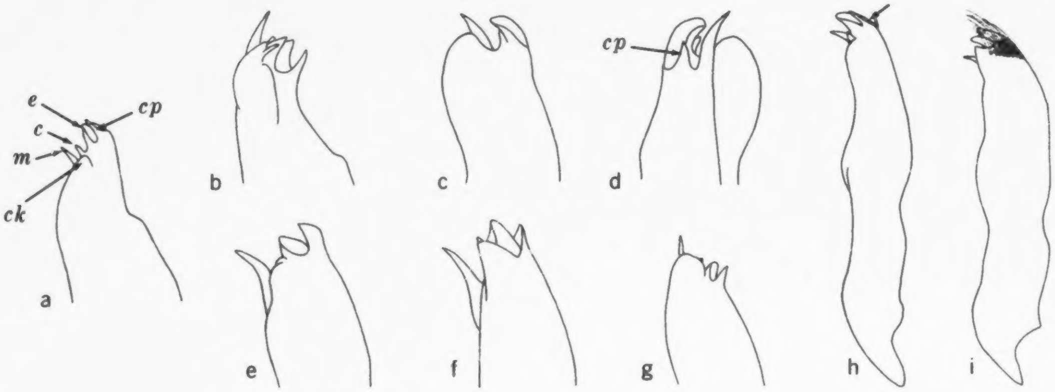

Fig. 54. a-c, e,g, Lateral view of distal portion of left first pleopods; d, Mesial view of same; h,i, Lateral view of left first pleopods. a, *Procambarus versutus*; b, *P. lylei*; c,d, *P. suttkusi*; e, *P. vioscai*; f, *P. penni*; g, *P. elegans*; h, *P. echinatus*; i, *P. dupratzi*. (*c*, caudal process; *ck*, caudal knob; *cp*, cephalic process; *e*, central projection; *m*, mesial process.)

7(6) First pleopod with subapical setae abundant, no part of central projection evident in lateral aspect cephalodistal to cephalic process (Fig. 54i):

Procambarus (*P.*) *dupratzi* Penn, 1953

(Streams in the Trinity, Red, Neches, Sabine, and Calcasieu river systems in Texas, Arkansas, and Louisiana. Literature: Penn, 1956b; Hobbs, 1962)

First pleopod with subapical setae sparse; part of central projection evident in lateral aspect cephalodistal to cephalic process (Fig. 54h, note arrow):

Procambarus (*P.*) *echinatus* Hobbs, 1956

(Streams in the Edisto and Salkehatchie river systems in South Carolina. Literature: Hobbs, 1956a, 1962)

8(6) Cephalic and mesial processes of first pleopod in lateral aspect diverging at angle of at least 50 degrees (Fig. 54f):
Procambarus (*P.*) *penni* Hobbs, 1951
(Tributaries of the Pearl and Pascagoula rivers in south-central Mississippi and Louisiana. Literature: Penn, 1956b; Hobbs, 1962)
Cephalic and mesial processes of first pleopod in lateral aspect subparallel or diverging at angle of much less than 50 degrees (Figs 54g, 55a,b)............................... 9

9(8) Cephalic process of first pleopod not reaching so far distally as caudal knob or caudal process (Fig. 54g):
Procambarus (*P.*) *elegans* Hobbs, 1969
(Streams in the Ouachita River system in northern Louisiana. Literature: Hobbs, 1969c)
Cephalic process of first pleopod reaching farther distally than caudal knob or caudal process (Fig. 55a,b)..........10

10(9) Central projection of first pleopod with cephalic margin rounded; caudal process small (Fig. 55a):
Procambarus (*P.*) *ablusus* Penn, 1963
(Streams in the Hatchie River system in Tennessee and Mississippi. Literature: Penn, 1963)
Central projection of first pleopod with cephalic margin virtually straight; caudal process prominent (Fig. 55b):
Procambarus (*P.*) *natchitochae* Penn, 1953
(Tributaries of the Red, Bayou Teche, and Calcasieu rivers in Texas, Arkansas, and Louisiana. Literature: Penn, 1956b, 1959; Hobbs, 1962)

11(3) Distolateral surface of shaft of first pleopod with longitudinal excavation extending proximally from base of central projection (Fig. 55c):
Procambarus (*P.*) *lagniappe* Black, 1968
(Tributaries of the Tombigbee River in Kemper County, Mississippi. Literature: Black, 1968)
Distolateral surface of shaft of first pleopod without such excavation (Fig. 55d-g)..................................12

12(11) Central projection of first pleopod arising from level distinctly proximal to base of caudal process (Fig. 55d,e)..13
Central projection of first pleopod arising from level distinctly distal to base of caudal process (Fig. 55f,g)....14

13(12) Caudodistal portion of shaft of first pleopod subtruncate with caudal element and central projection situated on cephalic 1/2 of tip (Fig. 55d): *Procambarus* (*P.*) *gibbus* Hobbs, 1969 (Streams in the Flint River system in southwestern Georgia. Literature: Hobbs, 1969c)

Caudodistal portion of shaft of first pleopod tapering with caudal element and central projection constituting almost entire tip (Fig. 55e):

Procambarus (*P.*) *spiculifer* (LeConte, 1856) (Streams from western Alabama to the Savannah River in Georgia. Literature: Hobbs, 1942b, 1962)

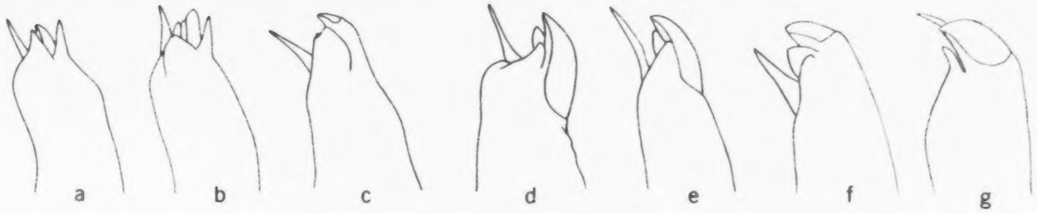

Fig. 55. Lateral view of distal portion of left first pleopods. a, *Procambarus ablusus*; b, *P, natchitochae*; c, *P. lagniappe*; d, *P. gibbus*; e, *P. spiculifer*; f, *P. ouachitae*; g, *P. raneyi*.

14(12) Caudal knob of first pleopod conspicuous; caudal process broad and leaflike in lateral aspect (Fig. 55f):

Procambarus (*P.*) *ouachitae* Penn, 1956 (Tributaries of the Arkansas and Ouachita rivers in Arkansas and Mississippi. Literature: Penn, 1956a; Hobbs, 1962)

Caudal knob of first pleopod vestigial; caudal process narrow and elongate (Fig. 55g):

Procambarus (*P.*) *raneyi* Hobbs, 1953 (Tributaries of the Savannah River in South Carolina and Georgia, and headwaters of the Ocmulgee River in Georgia. Literature: Hobbs, 1953c, 1962)

Key to Species of Subgenus *Scapulicambarus*

1 Cephalic process of first pleopod acute (Fig. 56a,b).......... 2

Cephalic process of first pleopod lobiform with or without angle on caudal margin (Fig. 56c-e)....................... 3

2(1) Distal portion of first pleopod tapering distally, in lateral aspect, from level of shoulder (Fig. 56a): *Procambarus* (*S.*) *howellae* Hobbs, 1952 (Lentic and lotic habitats in the lower piedmont and upper coastal plain of Georgia between the Oconee and Ogeechee rivers. Literature: Hobbs, 1952b, 1962)

Distal portion of first pleopod not markedly tapering distally, in lateral aspect, from level of shoulder (Fig. 56b; see also Fig. 6b): *Procambarus* (*S.*) *paeninsulanus* (Faxon, 1914) (Lentic and lotic habitats from the Choctawhatchee drainage in Florida to the St. Johns and St. Marys rivers, and from the Hillsborough River, Florida, northward to southeastern Alabama and southern Georgia. Literature: Hobbs, 1942b, 1962)

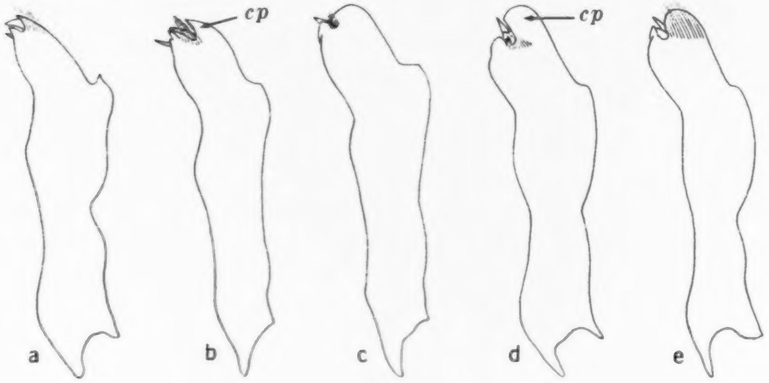

Fig. 56. Lateral view of left first pleopods. a, *Procambarus howellae*; b, *P. paeninsulanus*; c, *P. okaloosae*; d, *P. clarkii*; e, *P. troglodytes*. (*cp*, cephalic process.)

3(1) Areola less than 12 times longer than broad (see also Fig. 56c): *Procambarus* (*S.*) *okaloosae* Hobbs, 1942 (Lentic and lotic habitats in the Perdido, Escambia, and Yellow drainage systems in Alabama and Florida. Literature: Hobbs, 1942b, 1962)

Areola more than 12 times longer than broad (see also Fig. 56d, e).. 4

4(3) Caudal margin of cephalic process of first pleopod with distinct angle (Fig. 56d): *Procambarus* (*S.*) *clarkii* (Girard, 1852) (Lentic and lotic habitats from southern Illinois to northern México and Escambia County, Florida. Introduced in California, Hawaii, and Virginia. Literature: Penn, 1943; Hobbs, 1962)

Entire margin of cephalic process of first pleopod rounded, lacking angle (Fig. 56e): *Procambarus* (*S.*) *troglodytes* (LeConte, 1856) (Lentic and lotic habitats in the lower piedmont and coastal plain from the Pee Dee drainage system in South Carolina to the Altamaha drainage in Georgia. Literature : Faxon, 1885; Hobbs, 1962)

Key to Species of Subgenus *Villalobosus*

1 Mesial process (*m*) of first pleopod extending distinctly farther distally than other terminal elements (Fig. 57a-c)... 2

Mesial process of first pleopod extending little, if any, farther distally than other terminal elements (Fig. 57d-i) 4

2(1) Mesial process of first pleopod comparatively small and exceeding other terminal elements by no more than 1/2 their length (Fig. 57a):
Procambarus (*V.*) *hoffmanni* (Villalobos, 1944)
(Tributaries of the Río Tecolutla and Río Nautla in Puebla and Veracruz, México. Literature: Villalobos, 1955)

Mesial process of first pleopod very large and exceeding other terminal elements by at least 2/3 their length (Fig. 57b,c)... 3

3(2) Mesial process of first pleopod somewhat flattened and sinuous (at least caudal margin sinuous) (Fig. 57b); areola with no more than 2 punctations across narrowest part: *Procambarus* (*V.*) *tlapacoyanensis* (Villalobos, 1947)
(Tributaries of the Río Nautla in the vicinity of Tlapacoyan, Veracruz, México. Literature: Villalobos, 1955)

Mesial process of first pleopod conical and nearly straight (Fig. 57c); areola with more than 2 punctations across narrowest part:
Procambarus (*V.*) *teziutlanensis* (Villalobos, 1947)
(Headwater tributaries of the Río Nautla in Puebla and Veracruz, México. Literature: Villalobos, 1955)

4(1) First pleopod with 2 spiniform processes (mesial and cephalic) subequal in length, both projecting distally beyond other terminal elements (Fig. 57d; see also Fig. 6c):
Procambarus (*V.*) *riojai* (Villalobos, 1944)
(Headwater tributaries of the Río Cazones and Río Tecolutla in Hidalgo and Puebla, México. Literature : Villalobos, 1955)

First pleopod with only 1 conspicuous spiniform or subspiniform process (mesial), or, if cephalic process somewhat spiniform, never extending distally beyond other terminal elements (Fig. 57e-i)................................ 5

5(4) Cephalic process of first pleopod well developed, slender, never platelike, situated cephalomesially, and extending distally to or slightly beyond level of tip of mesial process (Fig. 57e): *Procambarus* (*V.*) *erichsoni* Villalobos, 1950 (Tributaries of the Río Pantepec (to Río Tuxpan) in the vicinity of Tenango de Doria, Hidalgo, México. Literature: Villalobos, 1955)

Cephalic process of first pleopod either forming curved crestlike plate, or very much reduced; never extending distally to level of tip of mesial process (Fig. 57f-i).... 6

6(5) Curved crestlike plate on cephalodistal surface of first pleopod flared from base (Fig. 57f): *Procambarus* (*V.*) *zihuateutlensis* Villalobos, 1950 (Headwater tributaries of the Río Tecolutla in the vicinity of Zihuateutla, Puebla, México. Literature: Villalobos, 1955)

Curved crestlike plate on cephalodistal surface of pleopod not flared from base, extending distally (Fig. 57g-i).......... 7

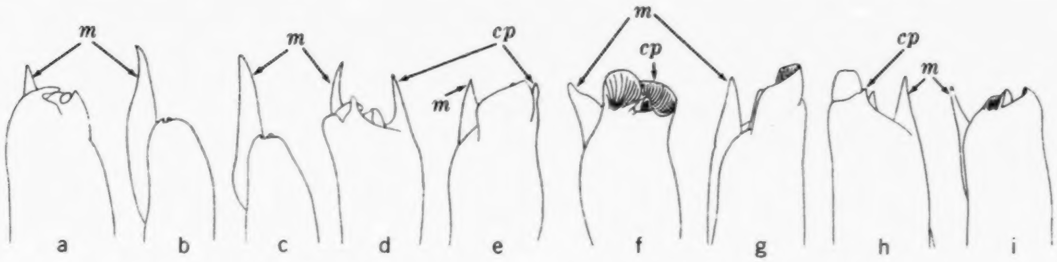

Fig. 57. a-g, i, Lateral view of distal portion of left first pleopods; h, Mesial view of same. a, *Procambarus hoffmanni*; b, *P. tlapacoyanensis*; c, *P. teziutlanensis*; d, *P. riojai*; e, *P. erichsoni*; f, *P. zihuateutlensis*; g,h, *P. contrerasi*; i, *P. hortonhobbsi*. (*cp*, cephalic process; *m*, mesial process.)

7(6) Central projection of first pleopod masked in lateral aspect by crestlike plate; cephalic process small and situated caudomesial to crestlike plate (Fig. 57g,h): *Procambarus* (*V.*) *contrerasi* (Creaser, 1931) (Tributaries of the Río Cazones and the Río Tecolutla in the vicinity of Zihuateutla and Agua Fría, Puebla, México. Literature: Villalobos, 1955)

Central projection of first pleopod clearly evident in lateral aspect; cephalic process forming crestlike plate (Fig. 57i): *Procambarus* (*V.*) *hortonhobbsi* Villalobos, 1950 (Stream at El Coyular, 7 km. northeast of La Unión, Municipio de Zihuateutla, Puebla, México. Literature: Villalobos, 1955)

KEY TO SPECIES OF GENUS *HOBBSEUS*
(Based on First-Form Male)

1 Central projection of first pleopod directed caudally at angle less than 90 degrees to main shaft of appendage (Fig. 58a,b) 2

Central projection of first pleopod directed caudally at angle of 90 degrees or more to main shaft of appendage (Fig. 58c-e) 3

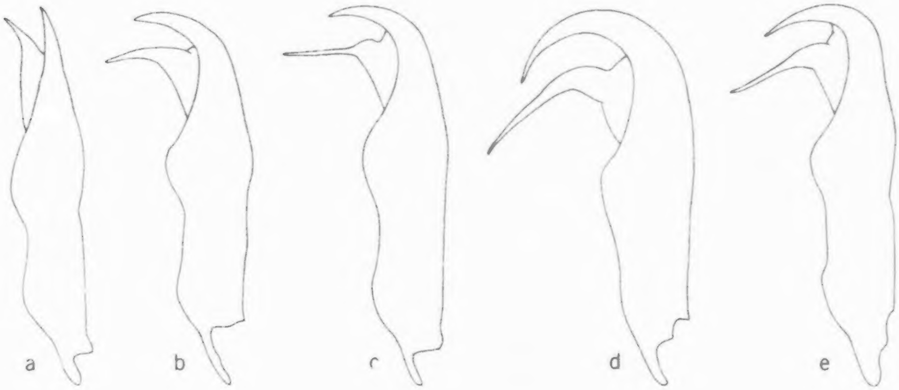

Fig. 58. Lateral view of left first pleopods. a, *Hobbseus orconectoides*; b, *H. cristatus*; c, *H. attenuatus;* d, *H. valleculus*; e, *H. prominens*.

2(1) Central projection of first pleopod directed caudally at less than 20 degrees to main shaft of appendage, mesial process at less than 45 degrees (Fig. 58a):

Hobbseus orconectoides Fitzpatrick and Payne, 1968
(Lentic habitat and burrows, 4.25 miles north of Starkville, Oktibbeha County, Mississippi. Literature: Fitzpatrick and Payne, 1968)

Central projection of first pleopod directed caudally at more than 45 degrees to main shaft of appendage, mesial process at approximately 90 degrees (Fig. 58b):

Hobbseus cristatus (Hobbs, 1955)
(Lentic and sluggish lotic habitats and burrows in Kemper, Lauderdale, Lowndes, and Noxubee counties, Mississippi. Literature: Fitzpatrick and Payne, 1968; Hobbs, 1955)

3(1) Mesial process of first pleopod directed caudally at 90 degrees to main shaft of appendage (Fig. 58c):

Hobbseus attenuatus Black, 1969
(Lentic habitats in the Pearl River drainage in Winston and Neshoba counties, Mississippi. Literature: Black, 1969)

Mesial process directed caudoproximally at more than 90 degrees to main shaft of appendage (Fig. 58d,e).................. 4

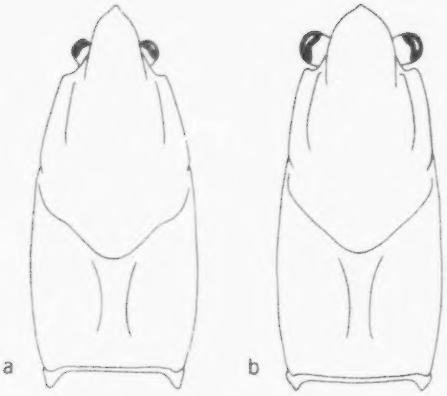

Fig. 59. Dorsal view of carapaces. a, *Hobbseus valleculus*; b, *H. prominens*.

4(3) Central projection of first pleopod forming broad arc with tip directed almost proximally (Fig. 58d); rostrum with margins tapering from base (Fig. 59a):

Hobbseus valleculus (Fitzpatrick, 1967)
(Stream tributaries of the Pearl River in Choctaw County, Mississippi. Literature: Fitzpatrick, 1967b; Fitzpatrick and Payne, 1968)

Central projection of first pleopod only slightly arched with tip directed caudoproximad (Fig. 58e); rostrum with convex margins (Fig. 59b):

Hobbseus prominens (Hobbs, 1966)
(Lentic and lotic habitats and burrows in Choctaw, Clarke, Dallas, Hale, Marengo, Perry, and Sumter counties, Alabama. Literature: Fitzpatrick and Payne, 1968; Hobbs, 1966)

KEY TO SPECIES OF GENUS *ORCONECTES*
(Based on First-Form Male)

NOTE: In using this key, the first pleopod must be viewed mesially. For comparative purposes, all of the illustrations of this appendage are made of the left member of the pair. See Fig. 3c for terminology and methods of measurements.

1 Central projection of first pleopod constituting 1/4 or less of total length of appendage (Figs 60, 63, 65, 67c-g)........ 2
Central projection of first pleopod constituting more than 1/4 total length of appendage (Figs 68c-g, 70, 72, 74, 77)... 32

2(1) Albinistic; eyes without pigment or facets.................. 3
Pigmented; eyes with pigment and facets...................... 8

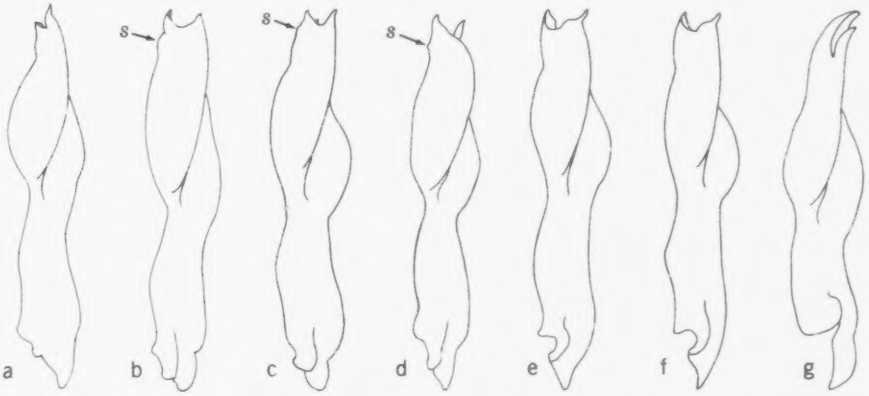

Fig. 60. Mesial view of left first pleopods. a, *Orconectes pellucidus*; b, *O. incomptus*; c, *O. a. australis*; d, *O. a. packardi*; e, *O. i. inermis*; f, *O. i. testii*; g, *O. harrisoni*. (*s*, shoulder.)

3(2) Mesial process of first pleopod extending distinctly farther distally than central projection (Fig. 60a; see also Fig. 11b): *Orconectes pellucidus* (Tellkampf, 1843) (Subterranean waters from Hart County to Trigg County, Kentucky, and Montgomery County, Tennessee. Literature: Hobbs and Barr, 1972)
Mesial process of first pleopod extending only slightly, if at all, farther distally than central projection (Fig. 60b-f).. 4

4(3) Cephalodistal portion of first pleopod with rounded or angular weak shoulder (*s*) at base of central projection (Fig. 60b-d) 5

Cephalodistal portion of first pleopod without shoulder at base of central projection (Fig. 60e,f)........................ 7

5(4) Rostrum without marginal spines or tubercles (Fig. 61a; see also Fig. 60b): *Orconectes incomptus* Hobbs and Barr, 1972 (Subterranean waters in Jackson County, Tennessee. Literature: Hobbs and Barr, 1972)

Rostrum with marginal spines or tubercles (Fig. 61b,c)........ 6

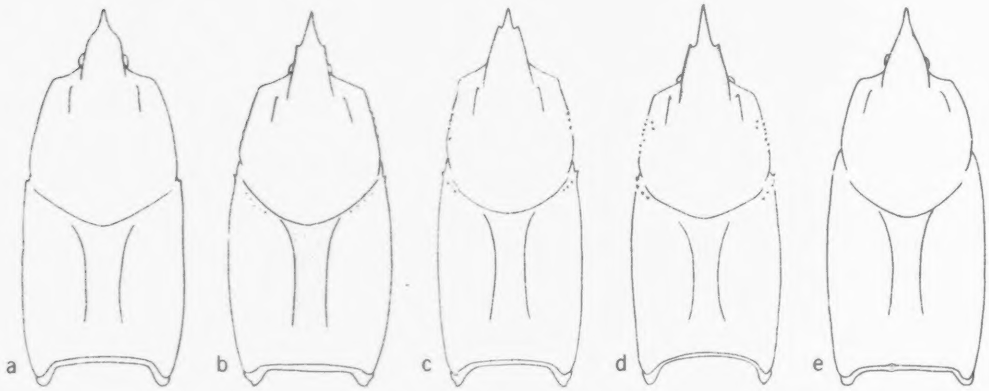

Fig. 61. Dorsal view of carapaces. a, *Orconectes incomptus*; b, *O. a. australis*; c, *O. a. packardi*; d, *O. i. inermis*; e, *O. i. testii*.

6(5) Cephalodistal portion of first pleopod with angular shoulder at base of central projection; caudal process absent (Fig. 60d; see also Fig. 61c): *Orconectes australis packardi* Rhoades, 1944 (Subterranean waters of the upper Cumberland drainage system in Kentucky, intergrading with the nominate subspecies in the vicinity of the Kentucky-Tennessee state line. Literature: Hobbs and Barr, 1972)

Cephalodistal portion of first pleopod with rounded shoulder at base of central projection; caudal process usually present (Fig. 60c; see also Figs 11a, 61b): *Orconectes australis australis* (Rhoades, 1941) (Subterranean waters in the northern tributaries of the Tennessee River in Jackson and Madison Counties, Alabama, north-northeastward on the Cumberland Plateau to near the Kentucky-Tennessee state line, there intergrading with *O. a. packardi*. Literature: Hobbs and Barr, 1972)

7(4) Rostrum with marginal spines or tubercles; areola constituting less than 43 per cent of total length of carapace (Fig. 61d; see also Figs 11c, 60e):

Orconectes inermis inermis Cope, 1871

(Subterranean waters from Green County, Kentucky, to Crawford County, Indiana, intergrading with *O. i. testii* northward to Monroe County, Indiana. Literature: Hobbs and Barr, 1972)

Rostrum without marginal spines or tubercles; areola constituting at least 43 per cent of total length of carapace (Fig. 61e; see also Fig. 60f):

Orconectes inermis testii (Hay, 1891)

(Subterranean waters of Monroe County, Indiana, intergrading southward to Crawford County with the nominate subspecies. Literature: Hobbs and Barr, 1972)

8(2) Central projection of first pleopod constituting less than 1/7 total length of appendage and both terminal elements directed caudodistally (Fig. 60g): *Orconectes harrisoni* (Faxon, 1884) (Streams in St. Genevieve and Washington counties, Missouri. Literature: Creaser, 1934a; Williams, 1954a)

Central projection of first pleopod usually constituting at least 1/6 total length of appendage (Figs 63, 65, 67c-g), if less, then both terminal elements never directed caudodistally (Fig. 65a).. 9

9(8) Areola obliterated or linear along part of length (Fig. 62a)... 10

Areola never obliterated along any part of length (Figs 62b-e, 67a,b).. 13

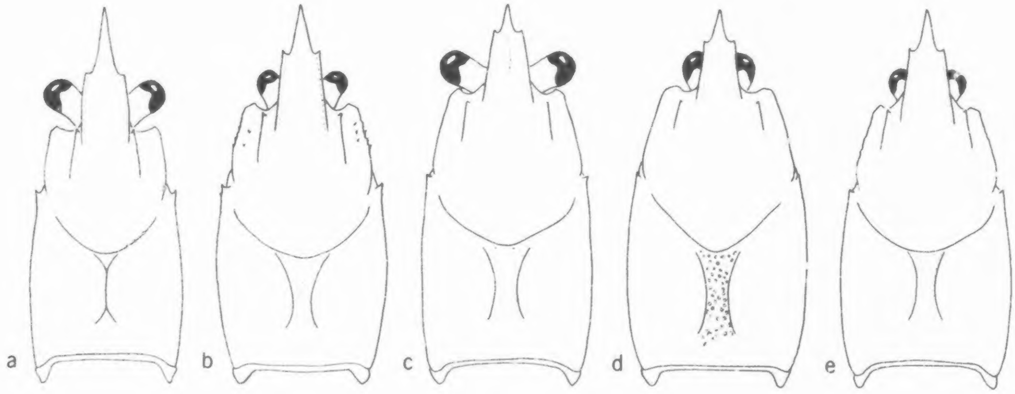

Fig. 62. Dorsal view of carapaces. a, *Orconectes lancifer*; b, *O. limosus*; c, *O, propinquus*; d, *O. eupunctus*; e, *O. erichsonianus*.

10(9) Rostrum with acumen as long as, or longer than, basal portion (Fig. 62a): *Orconectes lancifer* (Hagen, 1870) (Lentic and sluggish lotic habitats from Texas and Mississippi northward to extreme southern Illinois. Literature: Hobbs and Marchand, 1943; Penn, 1952; Penn and Hobbs, 1958)

Rostrum with acumen never as long as basal portion........... 11

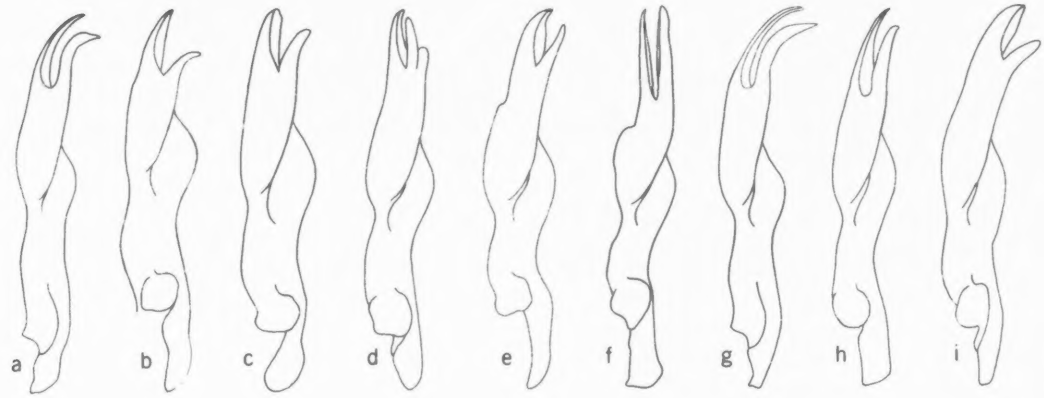

Fig. 63. Mesial view of left first pleopods. a, *Orconectes mississippiensis*; b, *O. difficilis*; c, *O. hathawayi*; d, *O. sanborni erismophorous*; e, *O. sloanii*; f, *O. obscurus*; g, *O. immunis*; h, *O. marchandi*; i, *O. kentuckiensis*.

11(10) Mesial process of first pleopod with basal portion directed distally and distal 1/3 bent caudally at right angle to principal axis of appendage (Fig. 63a): *Orconectes mississippiensis* (Faxon, 1884) (Streams and roadside ditches in eastern Mississippi and western Alabama. Literature: Faxon, 1884)

Mesial process of first pleopod directed caudodistally from base (Fig. 63b,c)...12

12(11) Central projection of first pleopod strongly tapering from base to acute apex (Fig. 63b): *Orconectes difficilis* (Faxon, 1898) (Streams from Latimer and Pittsburg counties, Oklahoma, and Upshur county, Texas, to Arkansas and western Louisiana. Literature: Penn, 1952; Reimer, 1968; Williams, 1954a)

Central projection of first pleopod gradually tapering to cleft or shallowly concave apex (Fig. 63c): *Orconectes hathawayi* Penn, 1942 (Streams from Jackson and Rapides parishes south to Vermilion Parish, Louisiana. Literature: Penn, 1952)

13(9) Mesial process of first pleopod with accessory lobe on caudal surface (Fig. 63d):
Orconectes sanborni erismophorous Hobbs and Fitzpatrick, 1962 (Streams in the Little Kanawha River system, West Virginia, intergrading with the nominate subspecies in neighboring streams. Literature: Fitzpatrick, 1967a)
Mesial process of first pleopod without accessory lobe on caudal surface (Figs 63e-i, 65, 67c-g)........................ 14

14(13) Cephalic surface of first pleopod with prominent angular or subangular shoulder (Fig. 63f):
Orconectes obscurus (Hagen, 1870) (Streams in southeastern Ontario, New York, Pennsylvania, eastern Ohio, and West Virginia, northern Virginia, and western Maryland. Literature: Crocker, 1957; Crocker and Barr, 1968; Fitzpatrick, 1967a; Ortmann, 1906)
Cephalic surface of first pleopod lacking prominent angular shoulder (Figs 63e,g-i, 65, 67c-g)...................... 15

15(14) Central projection of first pleopod inclined caudally throughout length (Fig. 63e,g-i)................................... 16
Central projection of first pleopod never inclined caudally throughout length (Figs 65, 67c-g)...................... 19

16(15) Terminal elements of first pleopod with apices directed caudally at angle of 90 degrees to principal axis of appendage (Fig. 63g; see also Fig. 5n):
Orconectes immunis (Hagen, 1870) (Lentic and sluggish lotic habitats from New England and Ontario westward to Wyoming and southward to Alabama. Literature: Crocker and Barr, 1968)
Terminal elements of first pleopod bent caudodistally but apices directed at angle distinctly less than 90 degrees to principal axis of appendage (Fig. 63e,h,i).................... 17

17(16) Central projection of first pleopod constituting more than 1/5 total length of appendage and tapering gradually from base to apex (Fig. 63h): *Orconectes marchandi* Hobbs, 1968 (Streams in the Spring River drainage system in Arkansas and Missouri. Literature: Williams, 1954a)
Central projection of first pleopod constituting less than 1/5 total length of appendage and bladelike (Fig. 63e,i).......18

18(17) Chela strongly pubescent with setae obscuring tubercles on opposable margins of fingers; areola with no more than 3 punctations across narrowest part; mesial process of first pleopod somewhat flattened and directed more caudally than distally (Fig. 63i); *Orconectes kentuckiensis* Rhoades, 1944 (Streams in Crittenden and Union counties, Kentucky, and Hardin County, Illinois. Literature: Rhoades, 1944a)

Chela weakly to moderately pubescent but not obscuring tubercles on opposable margins of fingers; areola with 4 or more punctations across narrowest part; mesial process of first pleopod subelliptical in cross-section and directed more distally than caudally (Fig. 63e):
Orconectes sloanii (Bundy, 1876)
(Streams in southern Indiana and southwestern Ohio. Literature: Eberly, 1955; Faxon, 1885; Rhoades, 1941a)

19(16) Terminal elements of first pleopod distinctly divergent (Fig. 65a-d)... 20

Terminal elements of first pleopod subparallel or convergent distally (Figs 65e-i, 67c-g)........................... 23

20(19) Carapace with hepatic spines (spines occasionally abraded in late intermolt individuals) (Fig. 62b; see also Figs 5 1, 65a):
Orconectes limosus (Rafinesque, 1817)
(Streams on the Atlantic slope from Maine to the lower James River in Virginia. Literature: Crocker, 1957; Ortmann, 1906; Rhoades, 1962)

Carapace without hepatic spines (Fig. 64a,b)................ 21

21(20) Length of mesial margin of palm of chela less than 1/2 length of dactyl (Fig. 64c; see also Figs 64a, 65b):
Orconectes shoupi Hobbs, 1948
(Streams in the Cumberland drainage system in the vicinity of Nashville. Literature: Hobbs, 1948a; Rhoades, 1962)

Length of mesial margin of palm of chela greater than 1/2 length of dactyl (Fig. 64d,e)................................ 22

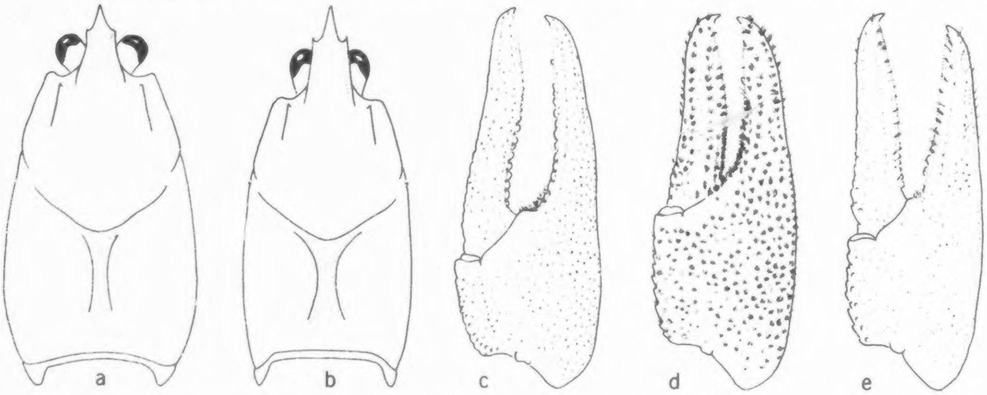

Fig. 64. a,b, Dorsal view of carapaces; c-e, Dorsal view of chelae. a, *Orconectes shoupi*; b, *O. indianensis*; c, *O. shoupi*, d, *O. wrighti*; e, *O. indianensis*.

22(21) Chela densely setose dorsally; in dorsal aspect, setae obscuring most tubercles on opposable surfaces of fingers (Fig. 64d; see also Fig. 65c): *Orconectes wrighti* Hobbs, 1948 (Streams in the Tennessee River drainage in Hardin County, Tennessee. Literature: Hobbs, 1948b; Rhoades, 1962)

Chela sparingly setose dorsally; in dorsal aspect, most tubercles on opposable surfaces of fingers clearly visible (Fig. 64e; see also Figs 64b,65d): *Orconectes indianensis* (Hay, 1896) (Streams in southern Illinois and Indiana. Literature: Eberly, 1955; Hay, 1896)

23(19) Rostrum with median carina (Fig. 62c)........................ 24

Rostrum without median carina (Fig. 62d,e)................... 25

24(23) Mesial process of first pleopod with acute apex (Fig. 65e; see also Figs 5m, 62c): *Orconectes propinquus* (Girard, 1852) (Streams and littoral areas of cold lentic habits from Ontario, Quebec and western New England southward to Pennsylvania and westward to Illinois and Wisconsin. Literature: Crocker and Barr, 1968; Fitzpatrick, 1967a)

Mesial process of first pleopod truncate or spatulate apically (Fig. 67e): *Orconectes iowaensis* Fitzpatrick, 1968 (Streams in the Mississippi drainage system in eastern Iowa. Literature: Fitzpatrick, 1968)

25(23) Tip of mesial process of first pleopod extending distally to or beyond tip of central projection (Fig. 65f-i)............ 26

Tip of mesial process of first pleopod not extending distally so far as central projection (Fig. 67c-g).................. 29

26(25) Central projection of first pleopod constituting at least 1/5 total length of appendage (Fig. 65f,g).................... 27

Central projection of first pleopod constituting less than 1/5 total length of appendage (Fig. 65h,i)................... 28

27(26) Dorsal surface of carapace with large, contiguous, deep punctations (Fig. 62d; see also Fig. 65f): *Orconectes eupunctus* Williams, 1952 (Streams in the Spring River and Eleven Point drainage systems in Arkansas and Missouri. Literature: Williams, 1954a)

Dorsal surface of carapace with small, moderately spaced, shallow punctations (Fig. 62e; see also Figs 65g, 66a): *Orconectes erichsonianus* (Faxon, 1898) (Streams in the Coosa and Tennessee drainage systems in Alabama, Georgia, Tennessee, and Virginia. Literature: Fitzpatrick, 1967a)

28(26) Mesial process of first pleopod twisted and extending slightly farther distally than central projection (Fig. 65h; see also Fig. 66b): *Orconectes tricuspis* Rhoades, 1944 (Streams in the Cumberland drainage system in Lyon, Trigg, and Christian counties, Kentucky. Literature: Rhoades, 1944a)

Mesial process not twisted and never extending farther distally than central projection (Fig. 65i): *Orconectes sanborni sanborni* (Faxon, 1884) (Tributaries of the Ohio River in Ohio, northeastern Kentucky, and West Virginia. Literature: Fitzpatrick, 1967a)

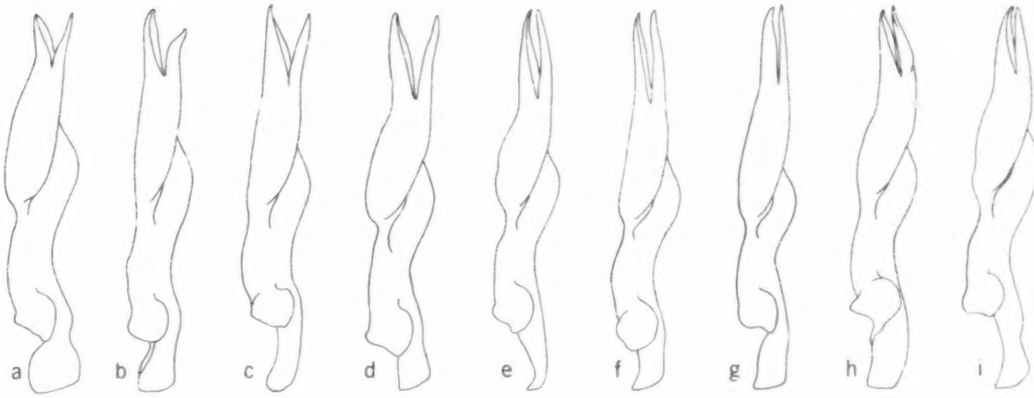

Fig. 65. Mesial view of left first pleopods. a, *Orconectes limosus;* b, *O. shoupi;* c, *O. wrighti;* d, *O. indianensis;* e, *O. propinquus;* f, *O. eupunctus;* g, *O. erichsonianus;* h, *O. tricuspis;* i, *O. s. sanborni.*

29(25) Mesial margin of palm of chela greater than 1/2 length of dactyl (Fig. 66c,d) 30

Mesial margin of palm of chela as short as, or shorter than, 1/2 length of dactyl (Fig. 66e) 31

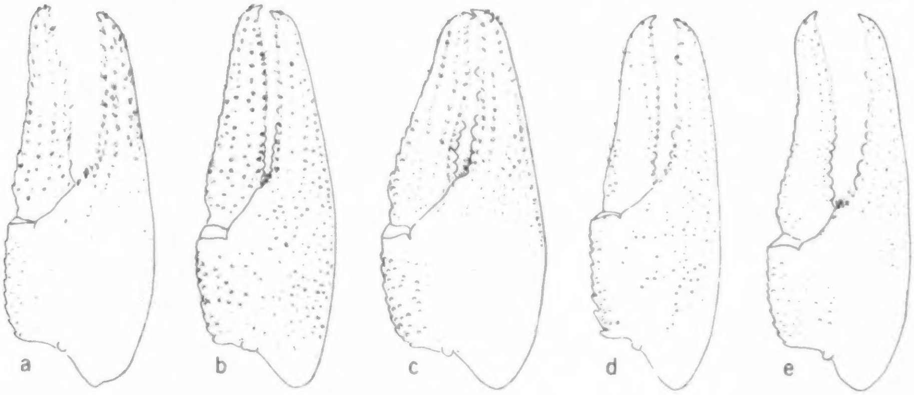

Fig. 66. Dorsal view of chelae. a, *Orconectes erichsonianus;* b, *O. tricuspis;* c, *O. rafinesquei;* d, *O. virginiensis;* e, *O. illinoiensis.*

30(29) Length of areola greater than 5 times its width (Fig. 67a; see also Figs 66c, 67c): *Orconectes rafinesquei* Rhoades, 1944 (Streams in the Rough River drainage in Kentucky. Literature: Rhoades, 1944a)

Length of areola not more than 5 times its width (Fig. 67b; see also Figs 66d, 67d):*Orconectes virginiensis* Hobbs, 1951 (Streams in the Chowan River drainage in North Carolina and Virginia. Literature: Fitzpatrick, 1967a)

31(29) Central projection of first pleopod tapering from base to acute apex (Fig. 67f; see also Fig. 66e): *Orconectes illinoiensis* Brown, 1956 (Streams in southern Illinois. Literature: Fitzpatrick, 1967a)

Central projection of first pleopod bladelike with truncate or rounded apex (Fig. 67g): *Orconectes bisectus* Rhoades, 1944 (Streams in the Crooked Creek drainage in Crittenden County, Kentucky. Literature: Prins and Fitzpatrick, 1965; Rhoades, 1944a)

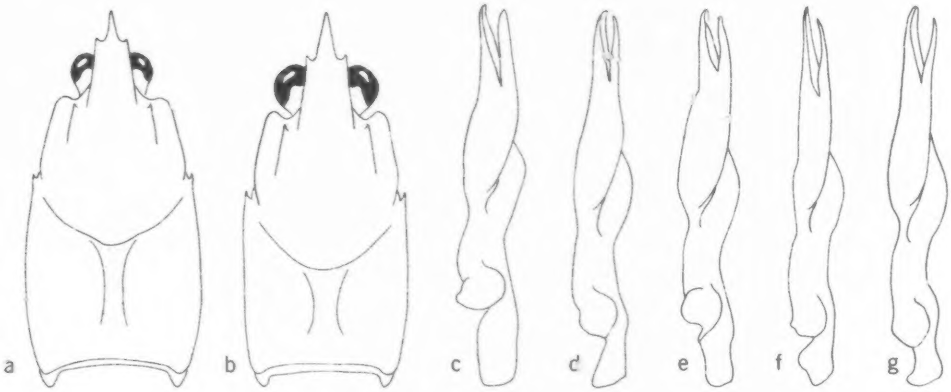

Fig. 67. a-b, Dorsal view of carapaces; c-g, Mesial view of left first pleopods. a, *Orconectes rafinesquei;* b, *O. virginiensis;* c, *O. rafinesquei;* d, *O. virginiensis;* e, *O. iowaensis;* f, *O. illinoiensis;* g, *O. bisectus.*

32(1) Hooks on ischia of third and fourth pereiopods (Fig. 4c); mesial process of first pleopod broadened and deeply grooved distally (Fig. 68c):

Orconectes peruncus (Creaser, 1931)

(Streams in the headwaters of the St. Francis River in southeastern Missouri. Literature: Creaser, 1934a; Williams, 1954a)

Hooks on ischia of third pereiopods only (Fig. 4a), except in some populations of *O. hylas*; if present on fourth, mesial process never markedly broadened distally (Figs 68d-g, 70, 72, 74, 77).. 33

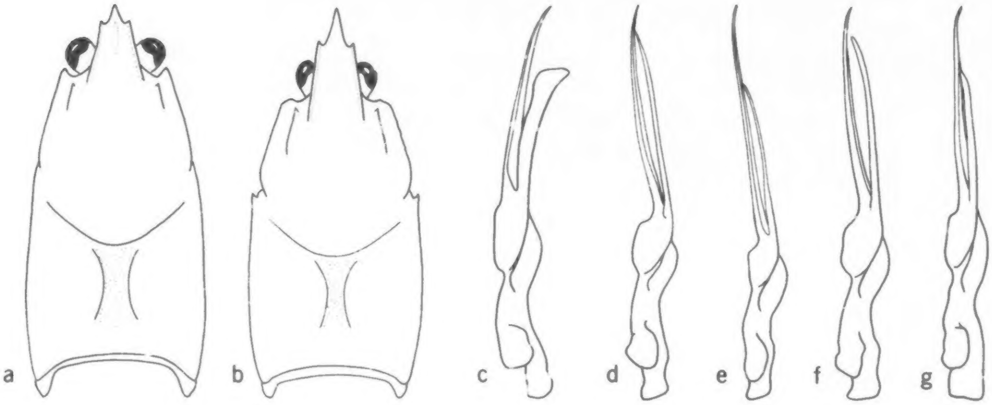

Fig. 68. a,b, Dorsal view of carapaces; c-g, Mesial view of left first pleopods. a, *Orconectes leptogonopodus*; b, *O. spinosus*; c, *O. peruncus*; d, *O. putnami*; e, *O. leptogonopodus*; f, *O. medius*; g, *O. spinosus*.

33(32) Central projection of first pleopod constituting at least 1/2 total length of appendage (Fig. 68d-g)................. 34

Central projection of first pleopod constituting less than 1/2 total length of appendage (Figs 70, 72, 74, 77)......... 37

34(33) Length of mesial margin of palm of chela no more than 1/2 length of dactyl (Fig. 69a; see also Fig. 68d):

Orconectes putnami (Faxon, 1844)

(Streams in the Ohio drainage in western Kentucky, southern Indiana (?), and Tennessee (?). The limits of the ranges of this species and the closely allied *O. juvenilis* and *O. spinosus* have not been determined. Literature: Ortmann, 1931, treated this species and *O. spinosus* as synonyms of *O. juvenilis*.

Length of mesial margin of palm of chela greater than 1/2 length of dactyl (Fig. 69b-d).......................... 35

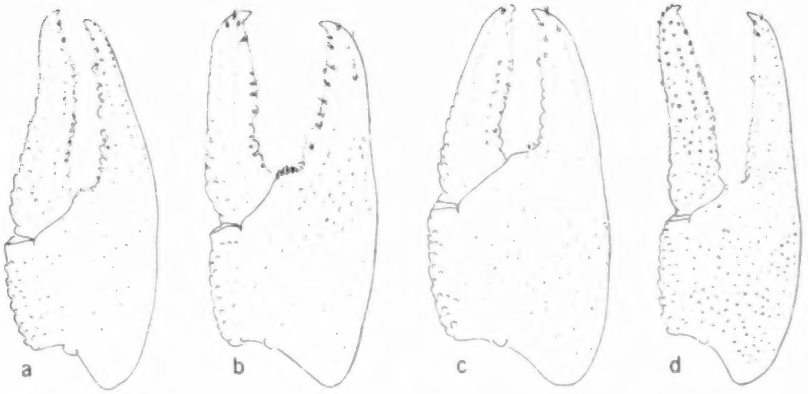

Fig. 69. Dorsal view of chelae. a, *Orconectes putnami*; b, *O. leptogonopodus*; c, *O. medius*, d, *O. spinosus*.

35(34) Rostrum with median carina (Fig. 68a; see also Figs 68e, 69b); *Orconectes leptogonopodus* Hobbs, 1948 (Streams in the Red River drainage system in Arkansas and eastern Oklahoma. Literature: Fitzpatrick, 1965; Williams, 1954a)

Rostrum without median carina (Fig. 68b).................. 36

36(35) Chela with large prominent punctations dorsally; width of palm greater than 1.4 times length of its mesial margin (Fig. 69c; see also Fig. 68f): *Orconectes medius* (Faxon, 1885) (Streams in the headwaters of the Big and Meramec rivers in southeastern Missouri. Literature: Creaser, 1934a; Williams, 1954a)

Chela with fine punctations dorsally; width of palm less than 1.4 times length of its mesial margin (Fig. 69d; see also Fig. 68b,g): *Orconectes spinosus* (Bundy, 1877) (Stream tributaries of the Coosa, Kanawha (?), and Tennessee rivers in Alabama, Georgia, eastern Tennessee, Virginia (?), and West Virginia (?); see statement in couplet 34. Literature: Ortmann, 1931, treated this species and *O. putnami* as synonyms of *O. juvenilis*.)

37(33) Both terminal elements of first pleopod curved caudally or caudodistally (Figs 70, 72)............................ 38

Mesial process of first pleopod never directed caudally or caudodistally (Figs 74, 77)............................ 52

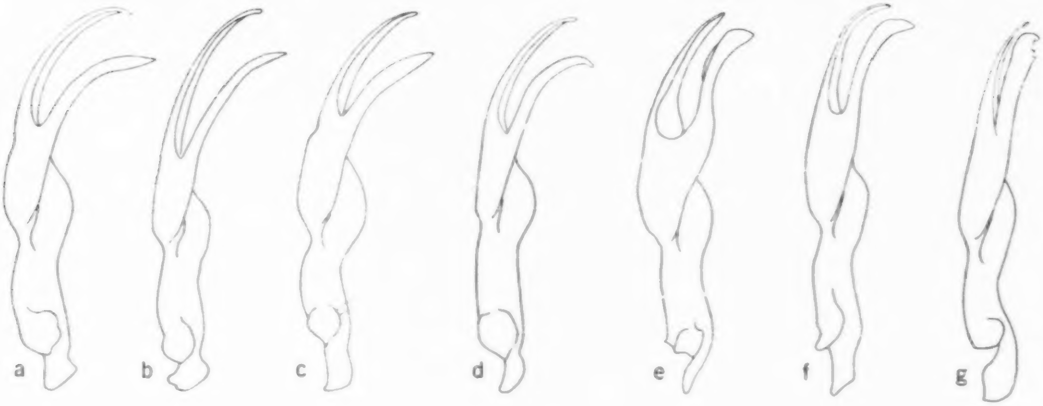

Fig. 70. Mesial view of left first pleopods. a, *Orconectes hobbsi*; b, *O. p. palmeri*; c, *O. p. creolanus*; d, *O. p. longimanus*; e, *O. compressus*; f, *O. alabamensis*; g, *O. quadruncus*.

38(37) Areola obliterated along part of length or so reduced in width as to accommodate no punctations in narrowest part (Fig. 71a,b)... 39

Areola broad or narrow but always with room for at least one punctation in narrowest part (Fig. 71c,d)............... 42

39(38) Areola not obliterated along any part of length (Fig. 71a; see also Fig. 70a): *Orconectes hobbsi* Penn, 1950 (Streams in the Lake Pontchartrain watershed in Louisiana and Mississippi. Literature: Penn, 1952)

Areola obliterated along part of length (Fig. 71b)......... 40

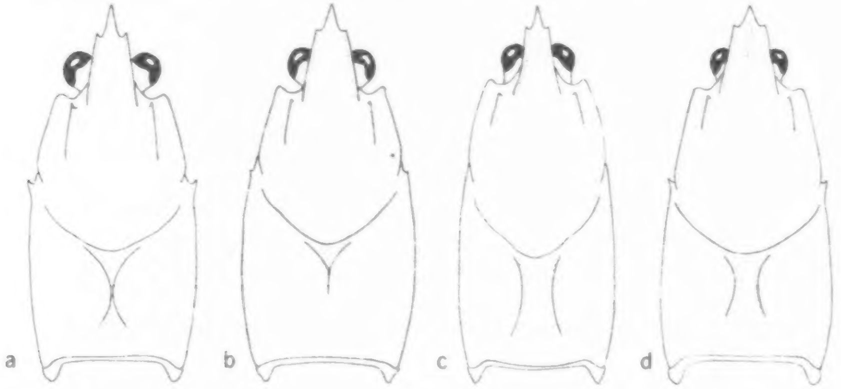

Fig. 71. Dorsal view of carapaces. a, *Orconectes hobbsi*; b, *O. p. palmeri*; c, *O. compressus*; d, *O. alabamensis*.

40(39) Central projection of first pleopod comprising more than 1/3 total length of appendage (Fig. 70b; see also Fig. 71b):
Orconectes palmeri palmeri (Faxon, 1884)
(Streams in the lower Mississippi Valley in western Tennessee, Mississippi, and Louisiana, and in eastern Missouri and Arkansas. Literature: Penn, 1957)
Central projection of first pleopod comprising less than 1/3 total length of appendage (Fig. 70c,d)................41

41(40) First pleopod with weak shoulder on cephalic surface at base of central projection (Fig. 70c):
Orconectes palmeri creolanus (Creaser, 1933)
(Streams in the Lake Pontchartrain watershed and the Pearl and Pascagoula river systems in Louisiana and Mississippi. Literature: Penn, 1957)
First pleopod with no trace of shoulder on cephalic surface at base of central projection (Fig. 70d):
Orconectes palmeri longimanus (Faxon, 1898)
(Western stream tributaries of the Mississippi River from the Arkansas River to the Gulf of Mexico, and streams westward to the Guadelupe River in Texas. Literature: Penn, 1957)

42(38) Rostrum with median carina; areola less than 5 times longer than broad (Fig. 71c,d)............................. 43
Rostrum lacking median carina; areola more than 5 times longer than broad................................... 44

43(42) Body strongly compressed laterally (Fig. 71c); distal portion of central projection of first pleopod not strongly recurved (Fig. 70e): *Orconectes compressus* (Faxon, 1884)
(Streams in the Tennessee, Cumberland, and Barren river systems in Alabama, Kentucky, Mississippi, and Tennessee. Literature: Rhoades, 1944a)
Body not strongly compressed laterally (Fig. 71d); distal portion of central projection of first pleopod strongly recurved (Fig. 70f): *Orconectes alabamensis* (Faxon, 1884)
(Streams in the Tennessee River system in the vicinity of the Alabama-Mississippi-Tennessee border. Literature: Faxon, 1885)

44(42) Mesial process of first pleopod with one or more prominences slightly proximal to caudodistal extremity (Fig. 70g):
Orconectes quadruncus (Creaser, 1933)
(Streams in the headwaters of the St. Francis River in Iron, St. Genevieve, and Madison counties, Missouri. Literature: Creaser, 1934a; Williams, 1954a)
Mesial process of first pleopod with no prominences slightly proximal to caudodistal extremity (Fig. 72)........... 45

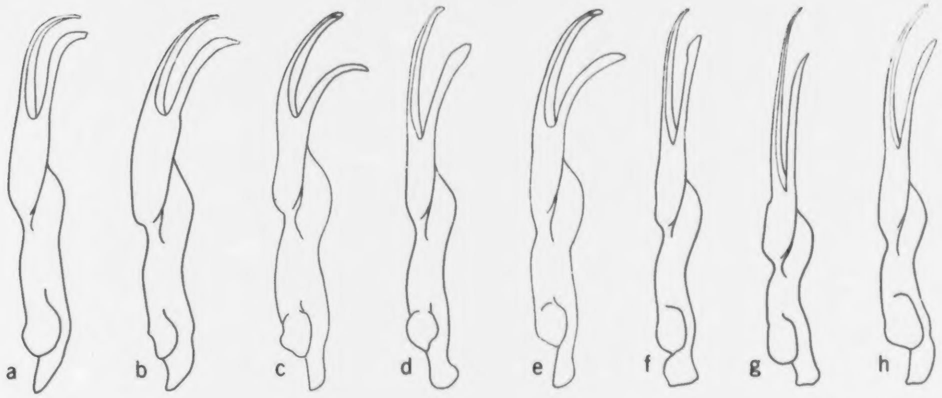

Fig. 72. Mesial view of left first pleopods. a, *Orconectes rhoadesi*; b, *O. validus*; c, *O. nais*; d, *O. m. meeki*; e, *O. m. brevis*; f, *O. longidigitus*; g, *O. punctimanus*; h, *O. virilis*.

45(44) Distal 1/4 of mesial process of first pleopod abruptly recurved caudally (Fig. 72a,b) 46

Distal 1/4 of mesial process of first pleopod not abruptly recurved caudally (Fig. 72c-h) 47

46(45) Principal axis of first pleopod almost straight (Fig. 72a): *Orconectes rhoadesi* Hobbs, 1949

(Stream tributaries of the Cumberland, Duck, and Tennessee rivers in Tennessee. Literature: Hobbs, 1949)

Principal axis of first pleopod inclined caudally (Fig. 72b): *Orconectes validus* (Faxon, 1914)

(Stream tributaries of the Tennessee River in Alabama and southern Tennessee. Literature: Faxon, 1914)

47(45) Central projection of first pleopod comprising less than 1/3 total length of appendage (Fig. 72c,e) (For method of measuring, see Fig. 3c) 48

Central projection of first pleopod comprising more than 1/3 total length of appendage (Fig. 72d, f-h) 49

48(47) Chela with conspicuous tuft of setae at base of fixed finger and with subserrate rows of tubercles on mesial surfaces of palm and dactyl (Fig. 73a; see also Fig. 72c):
Orconectes nais (Faxon, 1885)
(Streams in Kansas and Texas eastward to Arkansas; limits of its range not clearly defined for apparently often confused with *O. virilis*. Literature: Creaser and Ortenberger, 1933; Williams, 1954a; Williams and Leonard, 1952)

Chela without conspicuous tuft of setae at base of fixed finger and tubercles on mesial surfaces of palm and dactyl subsquamous (See also Fig. 72e):
Orconectes meeki brevis Williams, 1952
(Streams in the upper Arkansas River drainage in eastern Oklahoma and northwestern Arkansas. Literature: Williams, 1954a)

49(47) Dactyl of chela approximately 3 times length of mesial margin of palm (Fig. 73c; see also Fig. 72f):
Orconectes longidigitus (Faxon, 1898)
(Tributaries of the White and Little Red rivers in Missouri and Arkansas. Literature: Williams, 1954a)

Dactyl of chela distinctly less than 3 times length of mesial margin of palm (Fig. 73b,d,e)........................... 50

50(49) Central projection of first pleopod comprising almost 1/2 length of appendage (Fig. 72g; see also Fig. 73d):
Orconectes punctimanus (Creaser, 1933)
(Streams in the Missouri, St. Francis, and White rivers in Arkansas and Missouri. Literature: Williams, 1954a)

Central projection of first pleopod comprising much less than 1/2 length of appendage (Fig. 72d,h).................. 51

51(50) Mesial process of first pleopod rather strongly recurved (Fig. 72d); areola constituting less than 36 per cent of total length of carapace; tubercles on mesial surfaces of palm and dactyl subsquamous (Fig. 73b):
Orconectes meeki meeki (Faxon, 1898)
(Streams in the Arkansas, Red, and White river systems in Arkansas. Literature: Williams, 1954a)

Mesial process of first pleopod only moderately recurved (Fig. 72h); areola constituting more than 36 per cent of total length of carapace; tubercles on mesial surfaces of palm and dactyl distincly elevated (Fig. 73e):
Orconectes virilis (Hagen, 1870)
(Lentic and lotic habitats in Canada and the northern part of the United States; the southern boundary of its range is not known. Its relationships to *O. nais* and *O. causeyi*, the latter here considered a synonym, are far from clear. Introductions into Maryland, California, and perhaps elsewhere have resulted in its being one of the most widely dispersed crayfishes in North America. Literature: Crocker and Barr, 1968)

52(37) Central projection of first pleopod constituting less than 1/3 total length of appendage (Fig. 74a-c)................. 53

Central projection of first pleopod constituting more than 1/3 total length of appendage (Figs 74d-i, 77)............. 55

53(52) Cephalic surface of first pleopod without shoulder at base of central projection (Fig. 74a):

Orconectes jeffersoni Rhoades, 1944

(Streams in Beargrass Creek drainage in Jefferson County, Kentucky. Literature: Fitzpatrick, 1967a)

Cephalic surface of first pleopod with shoulder at base of central projection (Fig. 74b,c)....................... 54

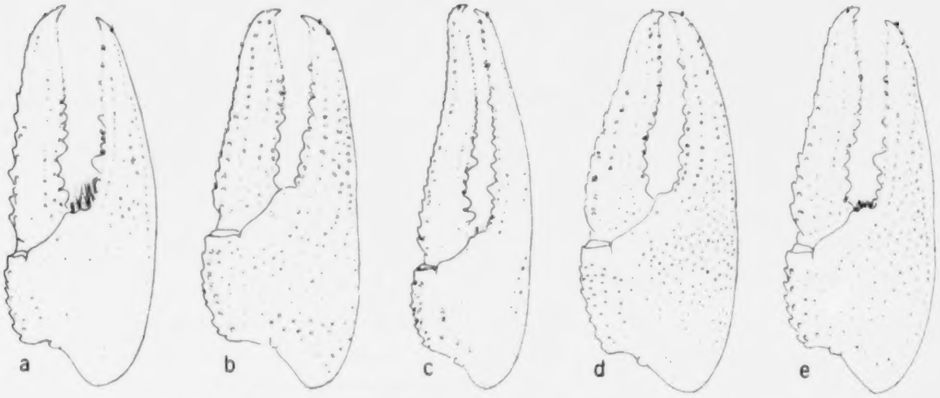

Fig. 73. Dorsal view of chelae. a, *Orconectes nais;* b, *O. m. meeki*; c, *O. longidigitus*; d, *O. punctimanus*; e, *O. virilis*.

54(53) Rostrum with median carina (Fig. 75a); fingers of chela inflated and gap between them greater than 1/4 width of palm (Fig. 75c; see also Fig. 74b):

Orconectes neglectus chaenodactylus Williams, 1952

(Streams in the North Fork of the White River drainage in Arkansas and Missouri, intergrading in the headwaters with the nominate subspecies. Literature: Williams, 1954a, 1954b)

Rostrum without median carina (Fig. 75b); fingers of chela somewhat flattened and gap between them less than 1/4 width of palm (Fig. 75d; see also Fig. 74c):

Orconectes rusticus (Girard, 1852)

(Streams from southern Ontario to Illinois, Ohio, and Kentucky; introduced in New England and perhaps elsewhere. Its relationships to other crayfishes treated by Ortmann, 1931, as subspecies are not clear. Literature: Crocker and Barr, 1968; Rhoades, 1944a; Ortmann, 1931)

55(52) Cephalic surface of first pleopod with shoulder or distinct bulge (Figs 74b*s*, d-i, 77a-d) 56

Cephalic surface of first pleopod without shoulder or distinct bulge (Fig. 77e-i) 68

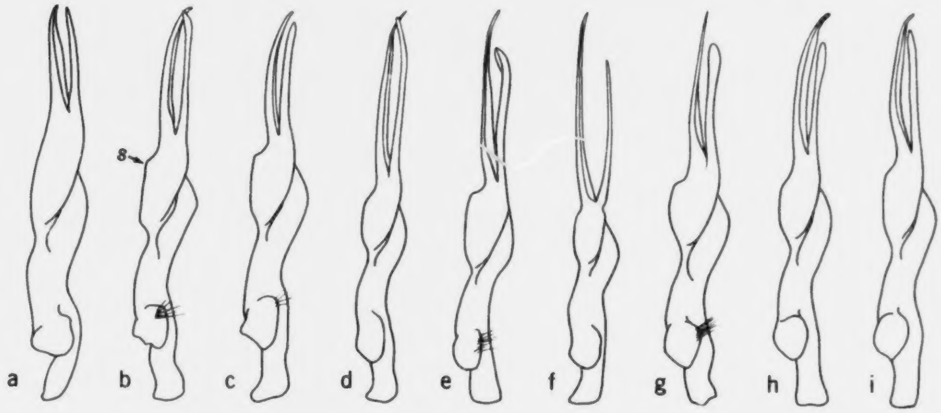

Fig. 74. Mesial view of left first pleopods. a, *Orconectes jeffersoni*; b, *O. neglectus chaenodactylus*; c, *O. rusticus*; d, *O. luteus*; e, *O. macrus*; f, *O. acares*; g, *O. nana*; h, *O. barrenensis*; i, *O. mirus*. (*s*, shoulder.)

56(55) First pleopods reaching coxae of first pereiopods when abdomen flexed (Fig. 78a) 57

First pleopods not reaching coxae of first pereiopods when abdomen flexed (Fig. 78b) 63

57(56) Areola comprising more than 35 per cent of total length of carapace 58

Areola comprising less than 35 per cent of total length of carapace 59

58(57) Distal margin of shoulder on cephalic surface of pleopod forming right angle with base of central projection (Fig. 74e): *Orconectes macrus* Williams, 1952 (Streams in the upper Arkansas River system in southwestern Missouri and northwestern Arkansas. Literature: Williams, 1954a)

Distal margin of shoulder on cephalic surface of pleopod distinctly sloping (Fig. 68f; see also Fig. 69c): *Orconectes medius* (Faxon, 1885) (See couplet 36 for range and literature)

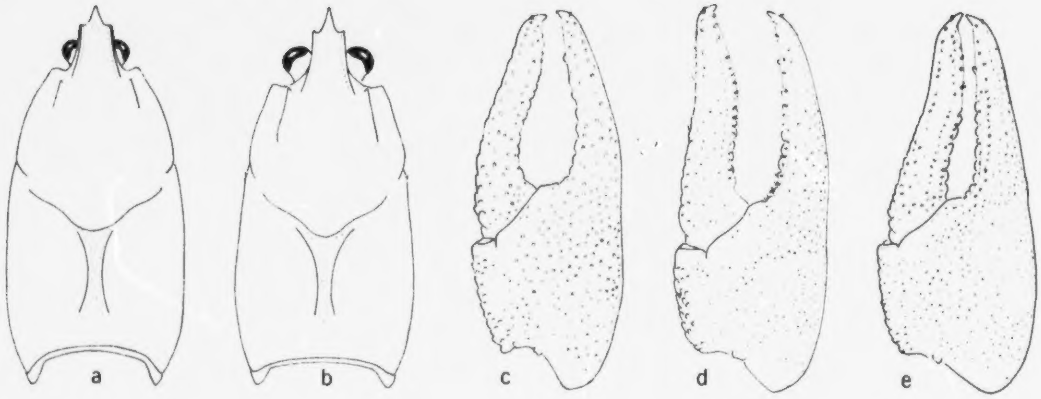

Fig. 75. a,b, Dorsal view of carapaces; c-e, Dorsal view of chelae. a, *Orconectes neglectus chaenodactylus;* b, *O. rusticus*; c, *O. n. chaenodactylus*; d, *O. rusticus*; e, *O. luteus*.

59(56) Areola less than 7 times longer than broad.................. 60
Areola more than 7 times longer than broad.................. 61

60(59) Cervical spines well developed (Fig. 68b; see also Figs 68g, 69d): *Orconectes spinosus* (Bundy, 1877)
(See couplet 36 for range and literature)
Cervical spines absent or represented by small tubercles (See also Fig. 74f): *Orconectes acares* Fitzpatrick, 1965
(Streams in the Ouachita drainage system in Arkansas. Literature: Fitzpatrick, 1965)

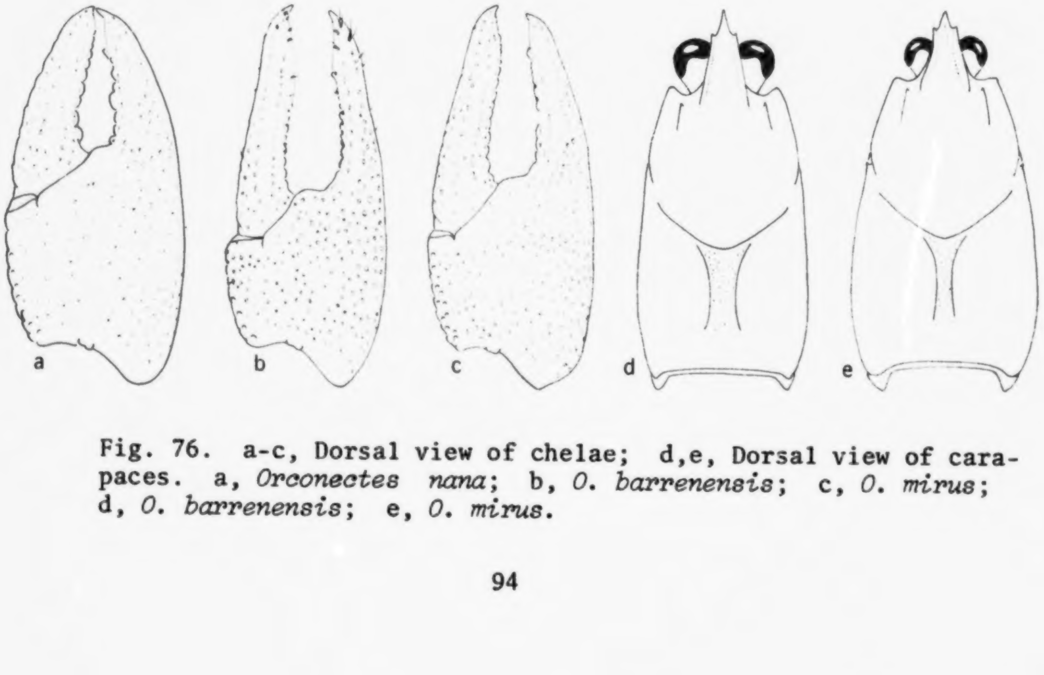

Fig. 76. a-c, Dorsal view of chelae; d,e, Dorsal view of carapaces. a, *Orconectes nana*; b, *O. barrenensis*; c, *O. mirus*; d, *O. barrenensis*; e, *O. mirus*.

61(59) Maximum subterminal diameter of mesial process of first pleopod greater than that of adjacent segment of central projection (Fig. 77a): *Orconectes hylas* (Faxon, 1890) (Streams in the Black and Big drainage systems in southeastern Missouri. Literature: Creaser, 1934a; Williams, 1954a)

Maximum subterminal diameter of mesial process of first pleopod less than that of adjacent segment of central projection (Fig. 77b,c).. 62

62(61) Shoulder on cephalic margin of first pleopod strongly developed; central projection gently curved from base (Fig. 77b): *Orconectes juvenilis* (Hagen, 1870) (Streams in the Ohio drainage system in northern Kentucky and in Indiana(?). The limits of the range of this species and the closely allied *O. putnami* and *O. spinosus* have not been determined. Literature: Ortmann, 1931 - latter two treated as synonyms of *O. juvenilis*)

Shoulder on cephalic margin of first pleopod very weakly developed; central projection rather strongly recurved distally (Fig. 77c): *Orconectes ozarkae* Williams, 1952 (Streams in the White River drainage system in Missouri and Arkansas. Literature: Williams, 1954a)

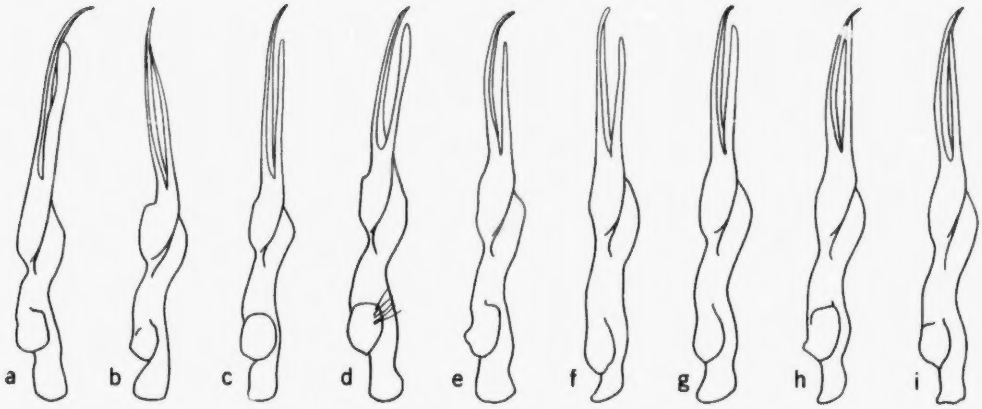

Fig. 77. Mesial view of left first pleopods. a, *Orconectes hylas*; b, *O. juvenilis*; c, *O. ozarkae*; d, *O. menae*; e, *O. transfuga*; f, *O. williamsi*; g, *O. n. neglectus*; h, *O. placidus*; i. *O. forceps*.

63(56) Lateral margin of fixed finger of chela bowed; maximum width of gap between fingers greater than 1/4 width of palm (Fig. 75c; see also Figs 74b, 75a):

Orconectes neglectus chaenodactylus Williams, 1952
(See couplet 54 for range and literature)

Lateral margin of fixed finger of chela evenly contoured with lateral margin of palm; maximum width of gap between fingers usually (except sometimes in *O. barrenensis* and *O. mirus*) less than 1/4 width of palm (Figs 75e, 76a-c, 79d)....... 64

64(63) Areola comprising more than 35 per cent of total length of carapace.. 65

Areola comprising less than 35 per cent of total length of carapace.. 66

65(64) Rostrum with median carina (Like Fig. 71d) or shallowly excavate (See also Figs 74d, 75e):

Orconectes luteus (Creaser, 1933)
(Stream tributaries of the Marais des Cygnes River, Kansas, eastward to the St. Francis River, Missouri and northern Arkansas. Literature: Williams, 1954a)

Rostrum with narrow, deep, longitudinal excavation between greatly thickened margins (See also Figs 74g, 76a):

Orconectes nana Williams, 1952
(Streams in the Spring River drainage in Arkansas and eastern Oklahoma. Literature: Williams, 1954a)

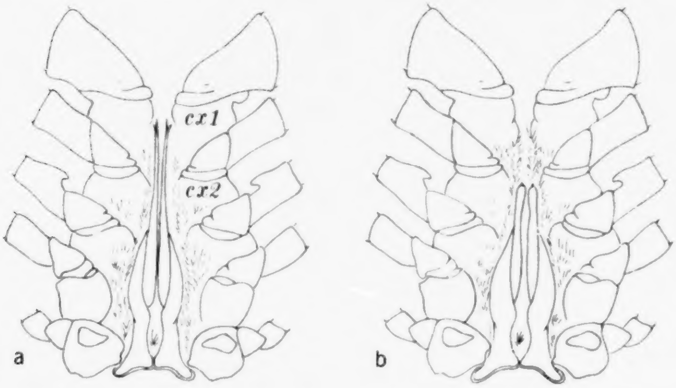

Fig. 78. Ventral view of thoracic region. a, Pleopods reaching coxae of first pereiopods (*cx1*); b, Pleopods reaching coxae of second pereiopods.

66(64) Areola more than 6 times longer than broad (Fig. 79c; see also Figs 77d, 79d): *Orconectes menae* (Creaser, 1933)
(Streams in the Ouachita River system in Polk and Montgomery counties, Arkansas, and the Red River system in Oklahoma. Literature: Williams, 1954a)

Areola less than 6 times longer than broad (Fig. 76d,e)..... 67

67(66) Shoulder on cephalic margin of first pleopod angular (Fig. 74i; see also Fig. 76c,e): *Orconectes mirus* (Ortmann, 1931) (Streams in the Elk and Duck drainage systems in Alabama and Tennessee. Literature: Ortmann, 1931)

Shoulder on cephalic margin of first pleopod broadly rounded (Fig. 74h; see also Fig. 76b,d): *Orconectes barrenensis* Rhoades, 1944 (Streams in the Barren River drainage in Kentucky and Tennessee and in the Green River system in Kentucky. Literature: Rhoades, 1944a)

68(55) Length of dactyl of chela less than twice that of mesial margin of palm (Fig. 80a,b)....................................... 69

Length of dactyl of chela greater than twice that of mesial margin of palm (Fig. 80c-e).............................. 71

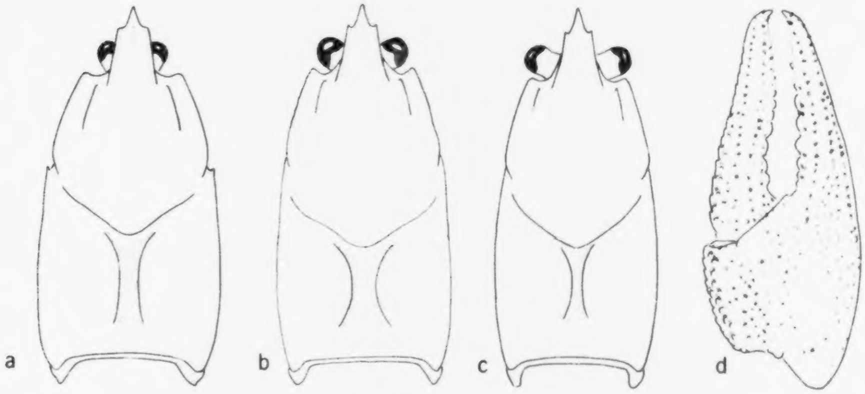

Fig. 79. a-c, Dorsal view of carapaces; d, Dorsal view of chelae. a, *Orconectes transfuga*; b, *O. williamsi*; c,d, *O. menae*.

69(68) Rostrum with median carina (Fig. 79a; see also Figs 77e, 80a): *Orconectes transfuga* Fitzpatrick, 1966 (Streams in the Rogue River drainage in Jackson County, Oregon. Literature: Fitzpatrick, 1966a)

Rostrum without median carina (Fig. 79b,c)...................70

70(69) Areola less than 10 times longer than wide (Fig. 79b; see also Figs 77f, 80b): *Orconectes williamsi* Fitzpatrick, 1966 (Streams in the headwaters of the White River in Madison County, Arkansas. Literature: Fitzpatrick, 1966b)

Areola more than 10 times longer than wide (Fig. 79c; see also Figs 77d, 79d): *Orconectes menae* (Creaser, 1933) (See couplet 66 for range and literature)

71(68) Length of dactyl of chela greater than 2.5 times length of mesial margin of palm (Fig. 80c; see also Fig. 77h):

Orconectes placidus (Hagen, 1870)

(Streams in the Cumberland, Duck, and Tennessee drainage systems in Kentucky, Tennessee, and Alabama. Literature: Ortmann, 1931)

Length of dactyl of chela less than 2.5 times length of mesial margin of palm (Fig. 80d,e)............................ 72

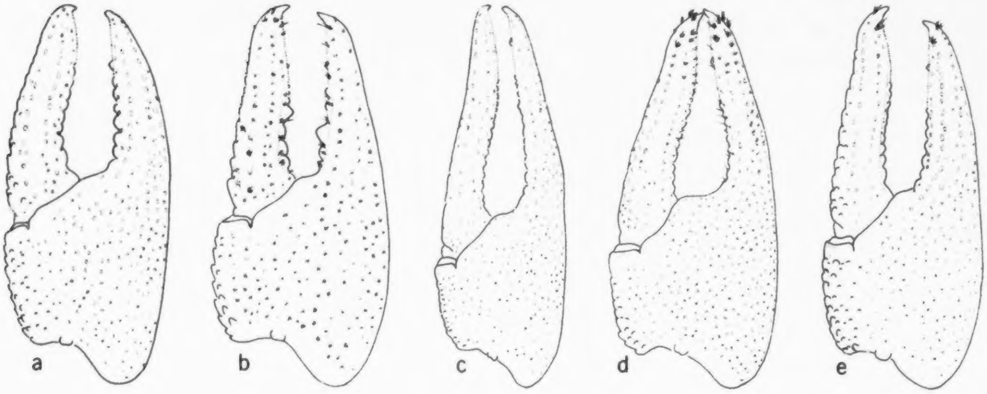

Fig. 80. Dorsal view of chelae. a, *Orconectes transfuga*; b, *O. williamsi*; c, *O. placidus*; d, *O. forceps*; e, *O. n. neglectus*.

72(71) Gap between closed fingers of chela more than 1/4 width of palm (Fig. 80d; see also Fig. 77i):

Orconectes forceps (Faxon, 1884)

(Streams in the Tennessee River system from southwestern Virginia to Alabama. Literature: Ortmann, 1931)

Gap between closed fingers of chela less than 1/4 width of palm (Fig. 80e; see also Fig. 77g):

Orconectes neglectus neglectus (Faxon, 1885)

(Streams in the White, except North Fork, and Arkansas river systems in Missouri, Oklahoma, and Arkansas, and in tributaries of the Kansas River in Colorado, Nebraska, and east central Kansas. Literature: Williams, 1954a, 1954b)

KEY TO SPECIES OF GENUS *FALLICAMBARUS*
(Based on First-Form Male)

1 First pleopod with distinct cephalic process (Fig. 81a, *cp*,b). 2
First pleopod lacking cephalic process (Figs 81c-f, 82)...... 3

2(1) Hooks on ischia of third and fourth pereiopods well developed (Fig. 4c; see also Fig. 81a)
Fallicambarus macneesei (Black, 1967)
(Pools and roadside ditches and probably burrows in the Calcasieu River system in Calcasieu Parish, Louisiana. Literature: Black, 1967)
Hooks on ischia of third pereiopods; hooks on fourth vestigial or absent (Fig. 4a; see also Fig. 81b):
Fallicambarus strawni (Reimer, 1966)
(Simple and complex burrows in Howard County, Arkansas. Literature: Reimer, 1966)

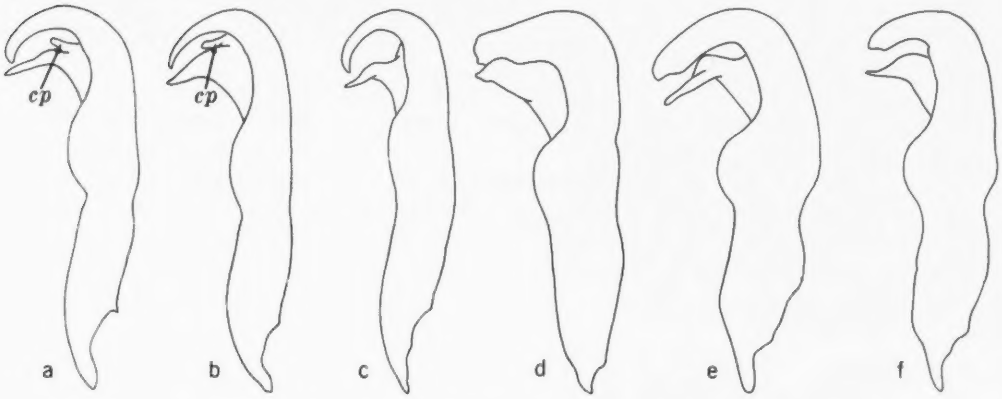

Fig. 81. Lateral view of left first pleopods. a, *Fallicambarus macneesei*; b, *F. strawni*; c, *F. dissitus*; d, *F. hortoni*; e, *F. byersi*; f, *F. oryktes*. (*cp*, cephalic process.)

3(1) Central projection of first pleopod directed strongly proximomesially, sometimes crossing that of other member of pair (Figs 81c, 82d): *Fallicambarus dissitus* (Penn, 1955)
(Burrows in Caldwell and Lincoln parishes, Louisiana. Literature: Penn and Marlow, 1959)
Central projection of first pleopod directed caudally or caudoproximally, never directed mesially or crossing that of other member of pair (Figs 81d-f, 82a-c)................. 4

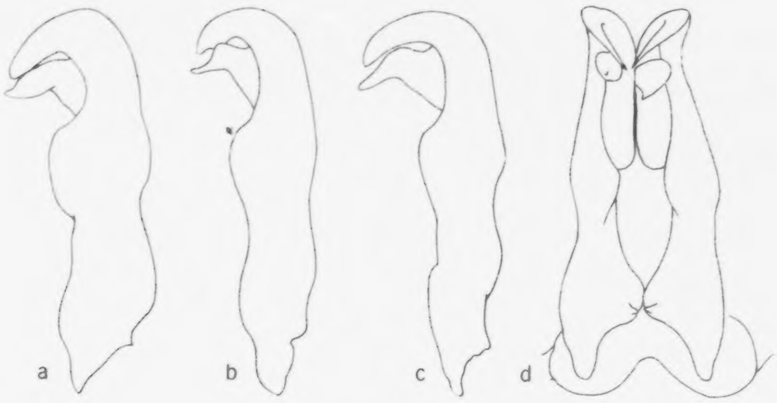

Fig. 82. First pleopods. a-c, Lateral view of left first pleopods. a, *Fallicambarus uhleri*; b, *F. fodiens*; c, *F. hedgpethi*; d, Caudal view of first pleopods of *F. dissitus*.

4(3) Central projection subtruncate, broad distally, and directed caudally (Fig. 81d):

Fallicambarus hortoni Hobbs and Fitzpatrick, 1970 (Burrows in the Hatchie River drainage, McNairy County, Tennessee. Literature: Hobbs and Fitzpatrick, 1970)

Central projection tapering and directed caudoproximally (Figs 81e-f, 82a-c)....................................... 5

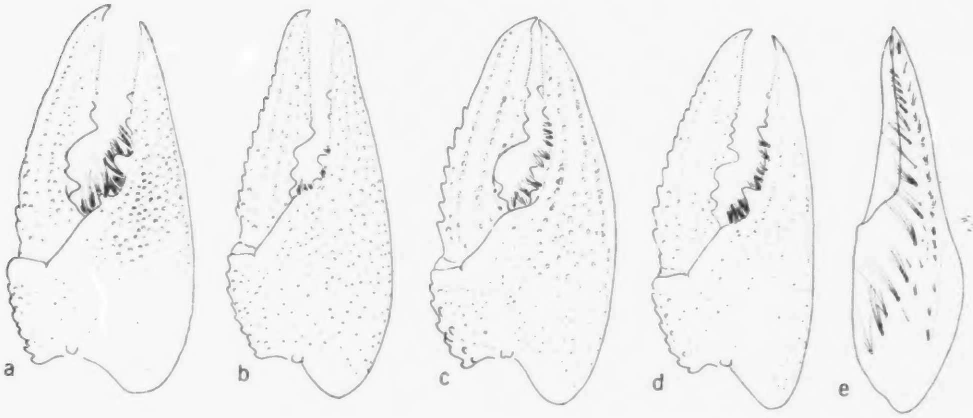

Fig. 83. Chelae. a-d, Dorsal view; e, Lateral view. a, *Fallicambarus oryktes*; b, *F. uhleri*; c, *F. fodiens*; d, *F. hedgpethi*; e, *f. byersi*.

5(4) Distal 1/2 of cephalic margin of first pleopod inclined caudally at angle of approximately 30 degrees (Fig. 81e); ventral surface of propodus of chela with longitudinal row of long stiff setae near lateral margin (Fig. 83e):
Fallicambarus byersi (Hobbs, 1941)
(Burrows from Hancock County, Mississippi, eastward to Okaloosa County, Florida. Literature: Hobbs, 1942b)

Distal 1/2 of cephalic margin of first pleopod inclined caudally at angle of less than 20 degrees (Figs 81f, 82a-c); ventral surface of propodus of chela without longitudinal row of long stiff setae near lateral margin.. 6

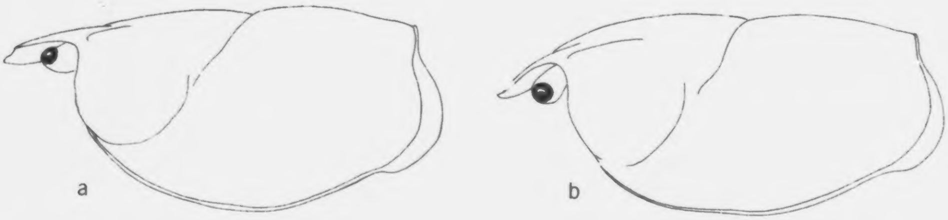

Fig. 84. Lateral view of carapaces. a, *Fallicambarus uhleri*; b, *F. fodiens*.

6(5) Mesial margin of dactyl of chela with irregularly arranged tubercles along proximal 1/2 but never with subserrate row (Fig. 83a; see also Fig. 81f):
Fallicambarus oryktes (Penn and Marlow, 1959)
(Burrows in St. Tammany Parish, Louisiana, and southern Mississippi. Literature: Penn and Marlow, 1959)

Mesial margin of dactyl of chela with subserrate row of tubercles along at least proximal 1/2 (Fig. 83b-d)........ 7

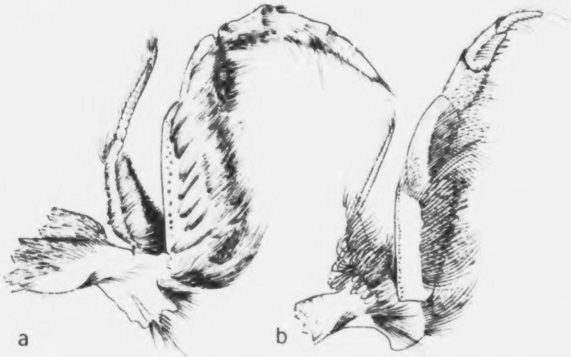

Fig. 85. Caudal view of third maxillipeds. a, *Fallicambarus uhleri*; b, *F. fodiens*.

7(6) Areola usually constituting less than 39 per cent of entire length of carapace; rostrum subplane dorsally and only moderately deflexed anteriorly (Fig. 84a); proximolateral 1/2 of postaxial surface of ischium of third maxilliped with many hirsute punctations mesial to lateral row (Fig. 85a; see also Figs 82a, 83b):

Fallicambarus uhleri (Faxon, 1884)

(Burrows, streams, and lentic habitats in the coastal plain from Maryland to South Carolina. Literature: Meredith and Schwartz, 1960)

Areola usually constituting more than 39 per cent of entire length of carapace; rostrum concave dorsally and strongly deflexed anteriorly (Fig. 84b); proximolateral 1/2 of postaxial surface of ischium of third maxilliped with few, if any, hirsute punctations mesial to lateral row (Fig. 85b)... 8

8(7) Hump on mesial process of first pleopod obscuring part of central projection in lateral aspect (Fig. 82b); central projection with subapical notch (often abraded in middle to late intermolt stages); opposable margin of fixed finger of chela with only 1 tubercle markedly larger than others (Fig. 83c; see also Figs 84b, 85b):

Fallicambarus fodiens (Cottle, 1863)

(Burrows, streams, and lentic habitats from lower Ontario, Michigan, Ohio, Indiana, Illinois southward to Arkansas and southwestern Georgia. The ranges of this species and the closely allied *F. hedgpethi* appear to overlap in Tennessee. Literature: Crocker and Barr, 1968)

Hump on mesial process of first pleopod never obscuring part of central projection in lateral aspect (Fig. 82c); central projection lacking subapical notch; opposable margin of fixed finger with 2 major tubercles (Fig. 83d):

Fallicambarus hedgpethi (Hobbs, 1943)

(Burrows and temporary bodies of water from Texas to Tennessee. Literature: Penn, 1959; Penn and Hobbs, 1958)

KEY TO SUBGENERA OF *CAMBARUS*
(Based on First-Form Male)

1 Antennae conspicuously fringed on mesial border (Fig. 86a); lateral margin of fixed finger of chela serrate (Fig. 89a,f) *Barbicambarus* Hobbs, 1969
Monotypic: *Cambarus (B.) cornutus* Faxon, 1884. (Streams in the Green River system in Kentucky. Literature: Faxon, 1885; Hobbs, 1969b)
Antennae not conspicuously fringed on mesial border (Fig. 86b); lateral margin of fixed finger never serrate (Fig. 89b-e, g-o).. 2

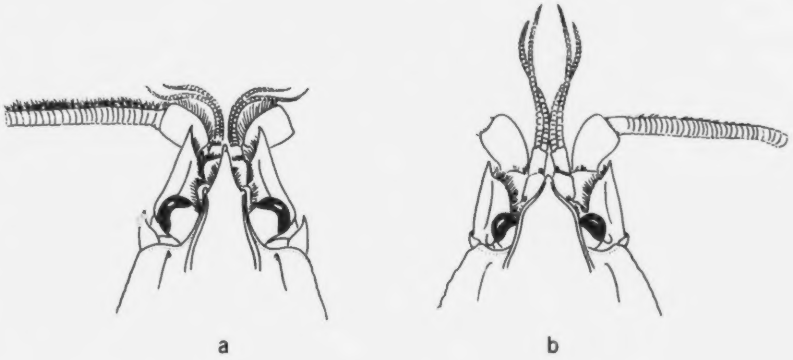

Fig. 86. Dorsal view of cephalic region. a, *Cambarus cornutus*; b, *C. b. bartonii*.

2(1) Albinistic; eyes without facets and pigment reduced or absent.3
Pigmented; eyes with facets and always pigmented.............5

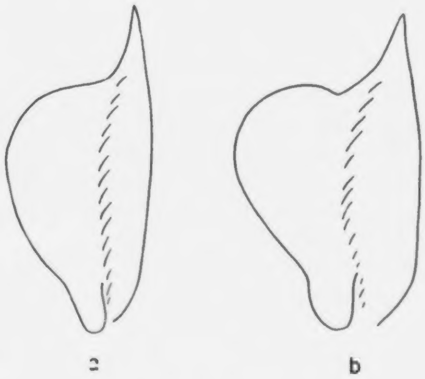

Fig. 87. Dorsal view of antennal scales. a, *Cambarus hamulatus*. b, *C. setosus*.

3(2) Eyes with pigment spot:
Erebicambarus Hobbs, 1969 (part) (p. 117)
Eyes without pigment.. 4

4(3) Antennal scale more than twice as long as broad (Fig. 87a):
Aviticambarus Hobbs, 1969 (p. 109)
Antennal scale less than twice as long as broad (Fig. 87b):
Jugicambarus Hobbs, 1969 (part) (p. 122)

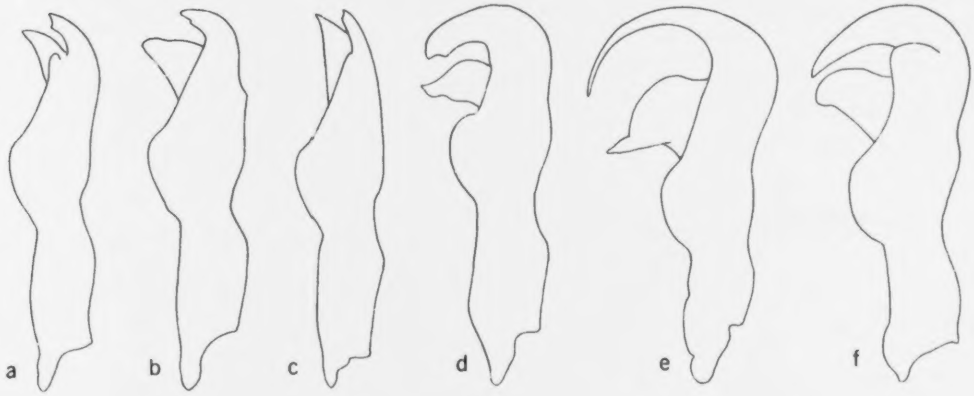

Fig. 88. Lateral view of left first pleopods. a, *Cambarus pristinus;* b, *C. obeyensis;* c, *C. bouchardi;* d, *C. b. bartonii;* e, *C. reduncus;* f, *C. friaufi.*

5(2) Central projection of first pleopod directed caudodistally at angle distinctly less than 90 degrees to principal shaft of appendage (Fig. 88a-c): *Veticambarus* Hobbs, 1969 (p. 131)
Central projection of first pleopod bent caudally at angle of at least 90 degrees to principal shaft of appendage (Fig. 88d-f).. 6

6(5) Fingers of chela with poorly defined dorsal longitudinal ridges, sometimes moderately well developed in *C. girardianus;* fingers widely gaping and usually with prominent cluster of plumose setae at base of fixed finger (Fig. 89b,c,k):
Hiaticambarus Hobbs, 1969 (p. 120)
Fingers of chela with moderate to strong dorsal longitudinal ridges; fingers seldom widely gaping and always lacking prominent cluster of plumose setae at base of fixed finger (Figs 89d,e,g,i, 90)................................ 7

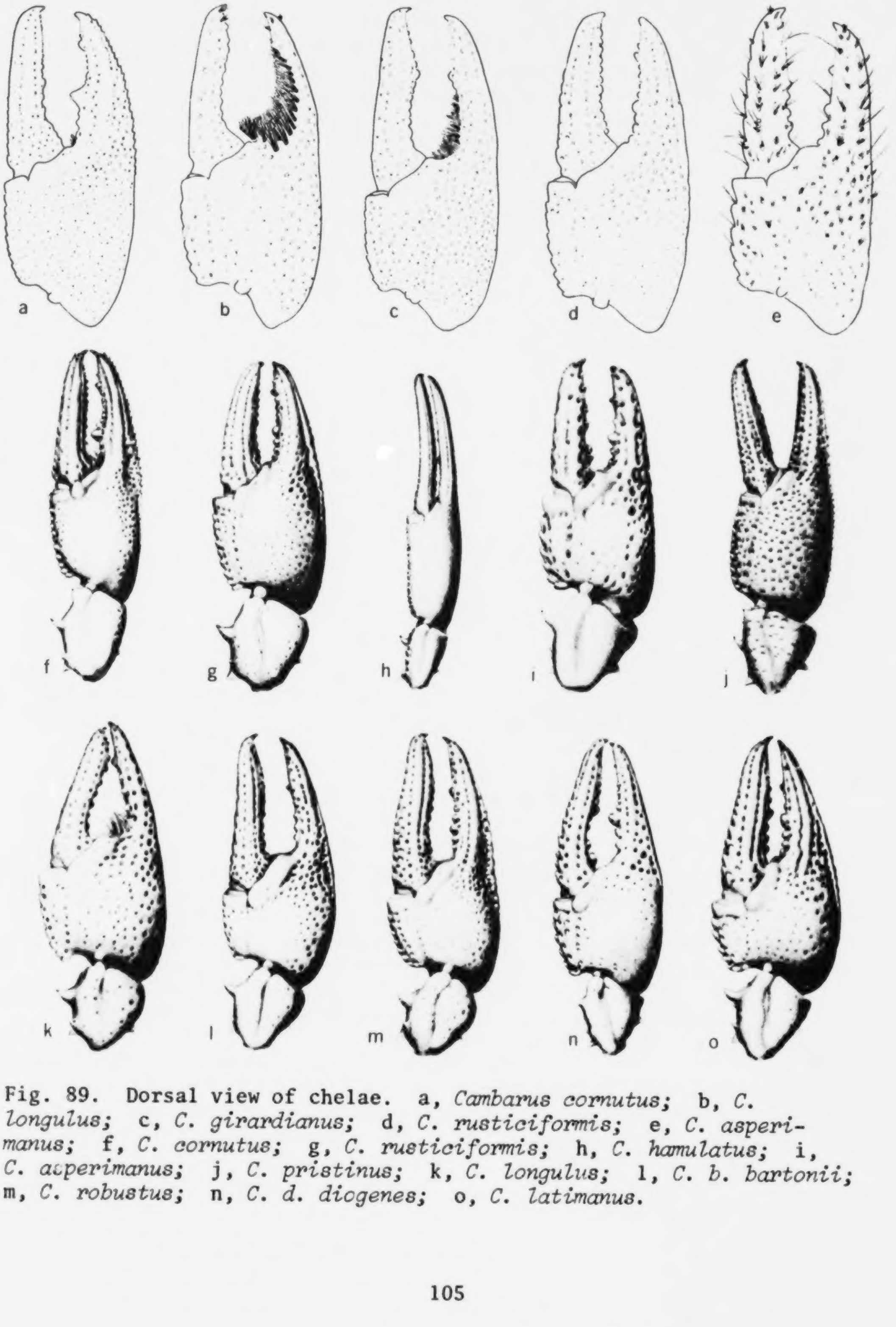

Fig. 89. Dorsal view of chelae. a, *Cambarus cornutus;* b, *C. longulus;* c, *C. girardianus;* d, *C. rusticiformis;* e, *C. asperimanus;* f, *C. cornutus;* g, *C. rusticiformis;* h, *C. hamulatus;* i, *C. asperimanus;* j, *C. pristinus;* k, *C. longulus;* l, *C. b. bartonii;* m, *C. robustus;* n, *C. d. diogenes;* o, *C. latimanus.*

7(6) Palm of chela with tubercles confined to 1 somewhat regular row along mesial margin, sometimes with poorly developed row of few scattered ones adjacent to row; dactyl never twice as long as mesial margin of palm (Figs 89d,e,g,i, 90a)........8

Palm of chela with 2 or more rows of tubercles along mesial margin (except in *C. nerterius* in which dactyl of chela is twice as long as length of mesial margin of palm (Fig. 90c) and in *C. veteranus* which has acuminate rostrum), often with additional tubercles dorsolateral to 2 rows (Figs 89m-o,90b, d,e)..10

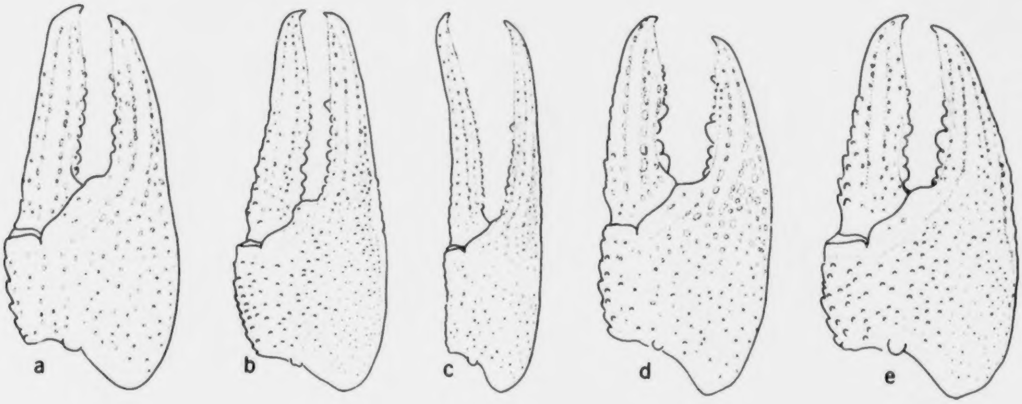

Fig. 90. Dorsal view of chelae. a, *Cambarus b. bartonii;* b, *C. extraneus;* c, *C. nerterius;* d, *C. d. diogenes;* e, *C. latimanus.*

8(7) Mesial margin of palm of chela with row of at least 8 tubercles; fingers never with conspicuous hairlike setae (Fig. 89d,g): *Erebicambarus* (part) (p. 117)

Mesial margin of palm of chela with row of fewer than 8 tubercles, or fingers with conspicuous hairlike setae (Figs 89e,i, 90a)......................................9

9(8) Color blue and/or palm of chela subquadrate (Fig. 89e); central projection of first pleopod without subapical notch (Fig. 109) or, if notch present, central projection either recurved at angle distinctly greater than 90 degrees (Fig. 106b,c) or very short (Fig. 106a): *Jugicambarus* Hobbs, 1969 (part) (p. 122)

Color olive to reddish brown; palm of chela not subquadrate (Fig. 90a); central projection of first pleopod with subapical notch, recurved at angle of approximately 90 degrees, and never conspicuously short (Fig. 88d): *Cambarus* Erichson, 1846 (p. 110)

10(7) Mesial margin of palm of chela usually with row of 8 or more tubercles (Figs 89d,g, 90b,c), if only 7 then row with obvious gap... 11

Mesial margin of palm of chela with row of fewer than 8 tubercles (Fig. 90d,e)... 12

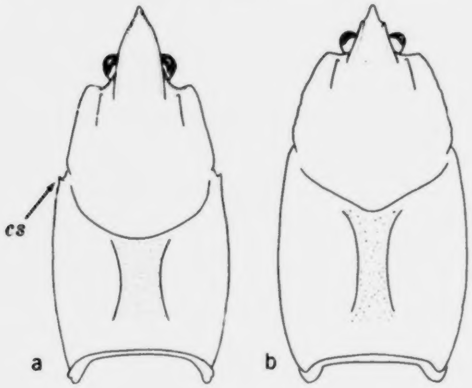

Fig. 91. Dorsal view of carapaces. a, *Cambarus reburrus;* b, *C. hubbsi.* (*cs*, cervical spine.)

11(10) Strong cervical spines present (Fig. 91a, *cs*); fixed finger of chela often with conspicuous deep dorsal and ventral impressions at base (Fig. 90b,c): *Puncticambarus* Hobbs, 1969 (p. 128)

Cervical spines present or absent (Fig. 91b); fixed finger of chela never with conspicuous dorsal and ventral impressions at base (Fig. 89d,g): *Erebicambarus* (part) (p. 117)

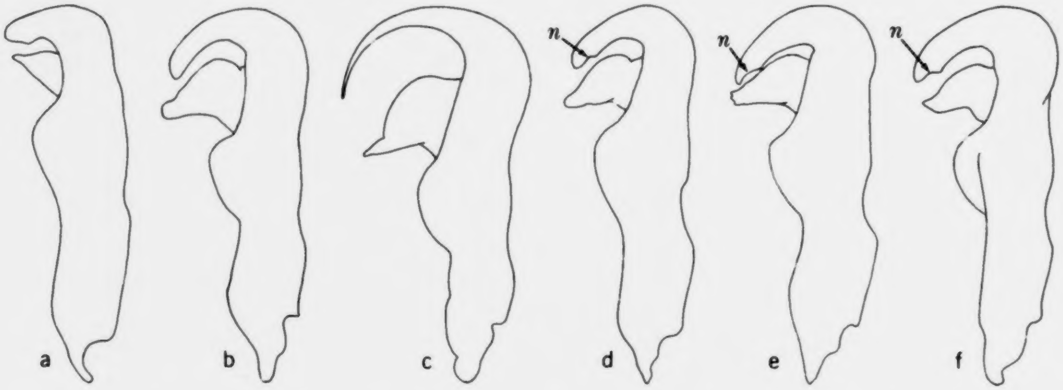

Fig. 92. Lateral view of left first pleopods. a, *Cambarus d. diogenes;* b, *C. latimanus;* c, *C. reduncus;* d, *C. halli;* e, *C. sphenoides;* f, *C. unestami.* (*n*, subapical notch.)

12(10) Dactyl of chela with broad concavity on basal 1/2 of opposable margin (Fig. 90d); first pleopod with central projection subequal in length to, or shorter than, cephalocaudal diameter of shaft at base of projection (Fig. 92a): *Lacunicambarus* Hobbs, 1969 (p. 127)

Dactyl of chela lacking broad concavity on basal 1/2 of opposable margin (Fig. 90e); first pleopod with central projection distinctly longer than cephalocaudal diameter of shaft at base of projection (Fig. 92b-d): *Depressicambarus* Hobbs, 1969 (p. 112)

Key to Species of Subgenus *Aviticambarus*

1 Areola less than 7 times longer than broad; hepatic area of carapace granulate (Fig. 93a); chela with long setae (Fig. 93c; see also Fig. 10b):

Cambarus (A.) jonesi Hobbs and Barr, 1960

(Subterranean waters in the Tennessee River system from Florence to just west of Guntersville, Alabama. Literature: Hobbs and Barr, 1960)

Areola 7 or more times longer than broad; hepatic area of carapace with spines or spiniform tubercles (Fig. 93b); chela without long setae (Fig. 93d; see also Figs 10a, 87a,89h): *Cambarus (A.) hamulatus* (Cope, 1881)

(Subterranean waters from the upper Sequatchie Valley, Tennessee, southward to Blount County, Alabama. Literature: Hobbs and Barr, 1960)

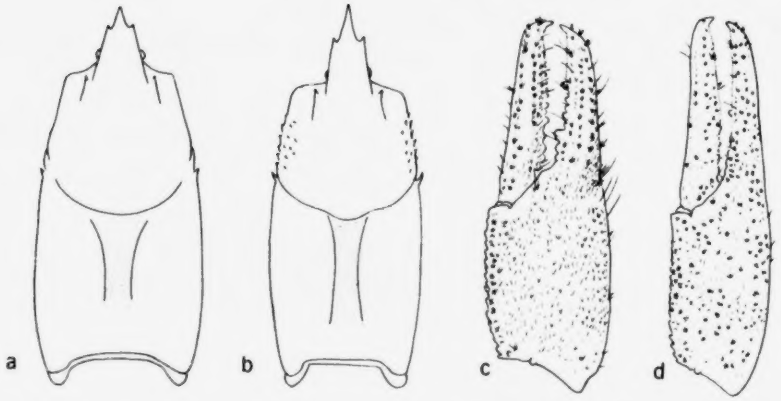

Fig. 93. a,b, Dorsal view of carapaces; c,d, Dorsal view of chelae. a, *Cambarus jonesi;* b, *C. hamulatus;* c, *C. jonesi;* d, *C. hamulatus.*

Key to Species of Subgenus *Cambarus*

1 Suborbital angle obsolete (Fig. 94a); areola constituting more than 40 per cent of entire length of carapace (Fig. 95a):
Cambarus (C.) ortmanni Williamson, 1907
(Lotic and lentic habitats and burrows in eastern Indiana, western Ohio, and adjacent northern Kentucky. Literature: Williamson, 1907; Rhoades, 1944a)

Suborbital angle present (Fig. 94b); areola constituting less than 40 per cent of entire length of carapace (Fig. 95b,c). 2

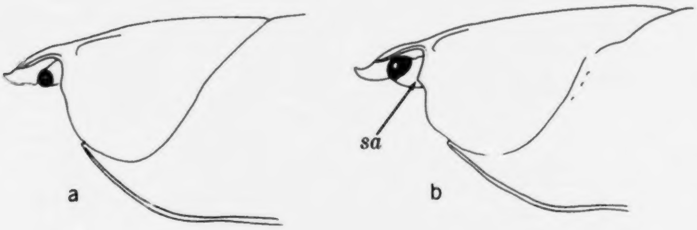

Fig. 94. Lateral view of cephalic region. a, *Cambarus ortmanni*; b, *C. b. bartonii*. (*sa*, suborbital angle.)

2(1) Rostrum acuminate (Fig. 95b):
Cambarus (C.) howardi Hobbs and Hall, 1969
(Lotic habitats in the Chattahoochee River system from Hall to Douglas County, Georgia. Literature: Hobbs and Hall, 1969)

Rostrum with margins somewhat abruptly contracted at base of acumen (Figs 95c, 96).................................... 3

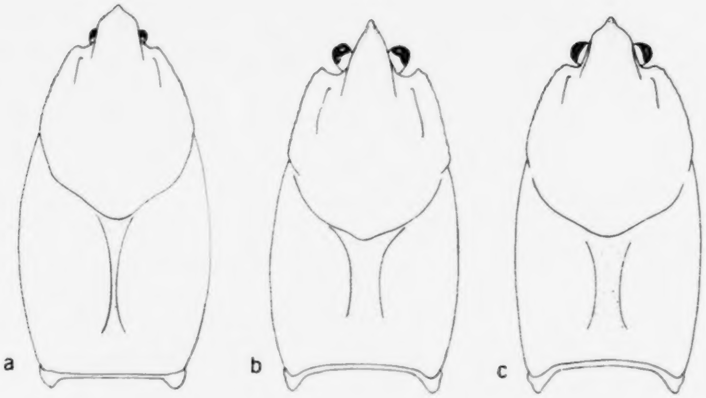

Fig. 95. Dorsal view of carapaces. a, *Cambarus ortmanni*; b, *C. howardi*; c, *C. bartonii carinirostris*.

3(2) Rostrum with broad, short median elevation (carina) on dorsal surface near apex (Fig. 95c):

Cambarus (C.) bartonii carinirostris Hay, 1914

(Lotic habitats in the Cheat, Greenbrier (?), and Tygart rivers, West Virginia. This is a local varient of *C. bartonii* and probably should not be recognized. Literature: Ortmann, 1931)

Rostrum without median elevation on dorsal surface near apex (Fig. 96)... 4

4(3) Rostrum with conspicuously thickened margins forming angular bend (occasionally with slightly projecting knobs) at base of acumen (Fig. 96a):

Cambarus (C.) sciotensis Rhoades, 1944

(Lotic habitats in the Scioto River drainage, Ohio, and Kanawha drainage in West Virginia and southwestern Virginia. Literature: Rhoades, 1944b)

Rostrum without conspicuously thickened margins, latter never forming angular bend or knobs at base of acumen (Fig. 96b, c).. 5

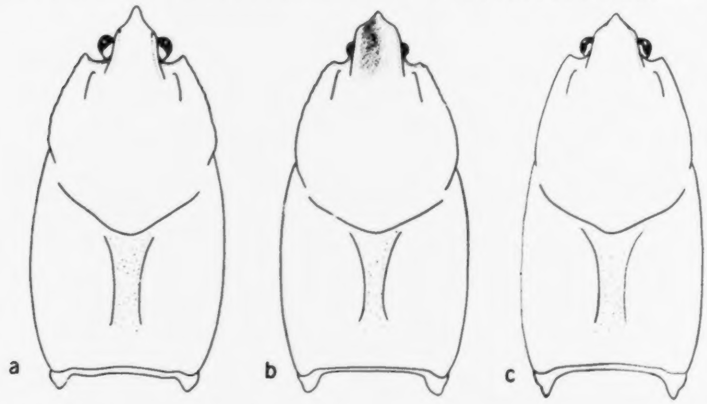

Fig. 96. Dorsal view of carapaces. a, *Cambarus sciotensis;* b, *C. bartonii cavatus;* c, *C. b. bartonii.*

5(4) Rostrum deeply excavate dorsally, often almost ladlelike (Fig. 96b): *Cambarus (C.) bartonii cavatus* Hay, 1902

(Lotic habitats in the Tennessee River drainage system from southwestern Virginia to Walden Gorge, Tennessee. It is questionable that this subspecies should be recognized. Literature: Ortmann, 1931)

Rostrum only shallowly excavate dorsally, never ladlelike (Fig. 96c; see also Figs 86b, 88d, 891, 90a, 94b):

Cambarus (C.) bartonii bartonii (Fabricius, 1798)

(Lotic and lentic habitats from New Brunswick, Canada, to northern Georgia, Ohio, and Tennessee; restricted to the mountains and foothills from North Carolina southward. Literature: Crocker and Barr, 1968; Ortmann, 1931)

Key to Species of Subgenus *Depressicambarus*

1 First pleopod with central projection bearing subapical notch (Figs 92d-f, 97a-c, *n*)............................... 2

First pleopod with central projection lacking subapical notch (Figs 97d,e, 98).. 6

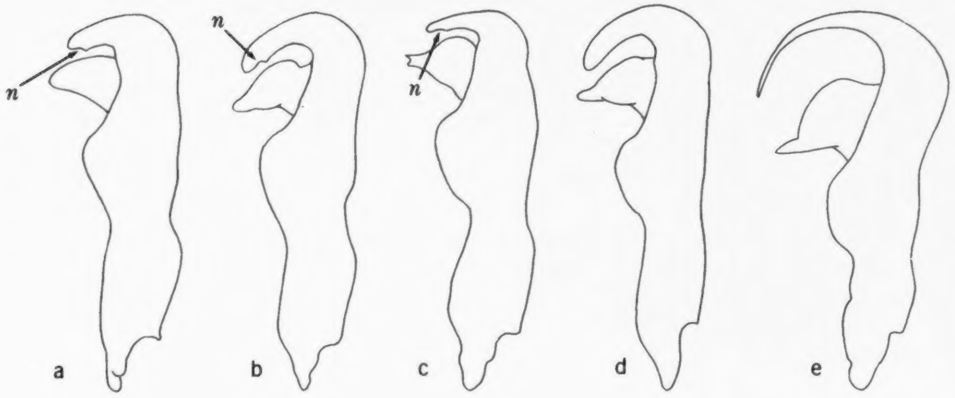

Fig. 97. Lateral view of left first pleopods. a, *Cambarus cymatilis*; b, *C. halli*; c, *C. obstipus*; d, *C. jordani*; e, *C. reduncus*. (*n*, subapical notch.)

2(1) Areola obliterated or linear (Fig. 99a; see also Fig. 97a): *Cambarus (D.) cymatilis* Hobbs, 1970

(Burrows in the Conasauga River drainage in northern Georgia. Literature: Hobbs, 1970b)

Areola with room for 2 or more punctations across narrowest part (Figs 99b,c, 100)................................. 3

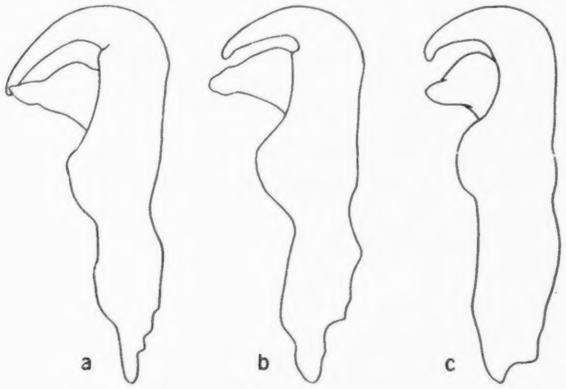

Fig. 98. Lateral view of left first pleopods. a, *Cambarus striatus*; b, *C. floridanus*; c, *C. catagius*.

3(2) Rostrum with marginal spines or tubercles (Fig. 99b,c)..... 4
Rostrum without marginal spines or tubercles (Fig. 100).... 5

4(3) Areola less than 5 times longer than broad, constituting less than 35 per cent of total length of carapace, and studded with crowded punctations (Fig. 99b; see also Fig. 97b):
Cambarus (D.) halli Hobbs, 1968
(Lotic habitats in the Tallapoosa River system in Alabama and Georgia. Literature: Hobbs, 1968a, 1969b)
Areola more than 5 times longer than broad, constituting more than 35 per cent of total length of carapace, and with scattered punctations (Fig. 99c; see also Fig. 97c):
Cambarus (D.) obstipus Hall, 1959
(Lotic habitats in the Black Warrior River system in Alabama. Literature: Hall, 1959; Hobbs, 1969b)

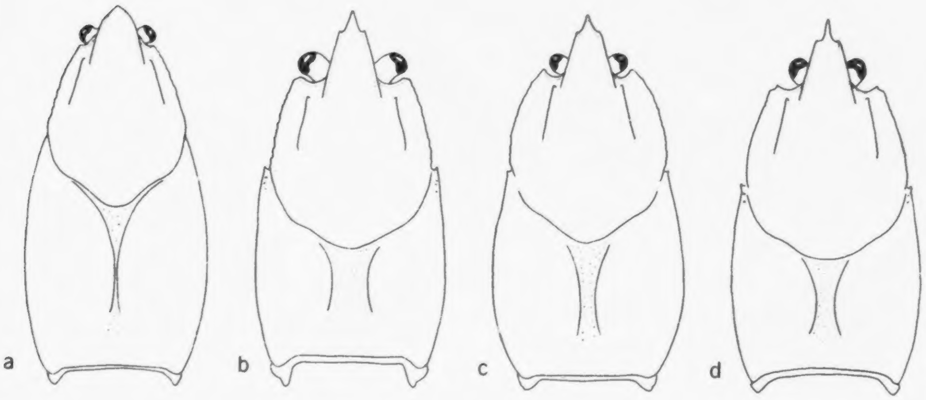

Fig. 99. Dorsal view of carapaces. a, *Cambarus cymatilis*; b, *C. halli*; c, *C. obstipus*; d, *C. jordani*.

5(3) Dorsal surface of palm of chela with many squamous tubercles (Fig. 101a); areola usually at least 5 times longer than broad and with 2 or 3 punctations across narrowest part (Fig. 100d; see also Fig. 92e):
Cambarus (D.) sphenoides Hobbs, 1968
(Lotic habitats in the upper Cumberland and Tennessee drainage systems in western Kentucky, Alabama, and Tennessee. Literature: Hobbs, 1968a, 1969b)
Dorsal surface of palm of chela with very few tubercles lateral to 2 mesial rows (Fig. 101b); areola always less than 5 times longer than broad and with 3 or more punctations across narrowest part (Fig. 100a; see also Fig. 92f):
Cambarus (D.) unestami Hobbs and Hall, 1969
(Tributaries of the Tennessee River in Dade County, Georgia. Literature: Hobbs and Hall, 1969; Hobbs, 1969b)

6(1) Acumen of rostrum delimited basally by marginal spines or tubercles, occasionally reduced to minute tubercle or distinct angle (Fig. 99c,d)........................ 7

Acumen of rostrum not delimited basally by marginal spines or tubercles, rounded at base of acumen (Fig. 100b,c). 8

7(6) Areola constituting less than 35 per cent of entire length of carapace and less than 8 times longer than broad (Fig. 99d; see also Fig. 97d):

Cambarus (D.) jordani Faxon, 1884

(Lotic habitats in the Coosa River system in Alabama and Georgia. Literature: Faxon, 1884)

Areola constituting more than 35 per cent of entire length of carapace and more than 8 times longer than broad (Fig. 99c; see also Fig. 97c):

Cambarus (D.) obstipus Hall, 1959

(See couplet 4 for range and literature)

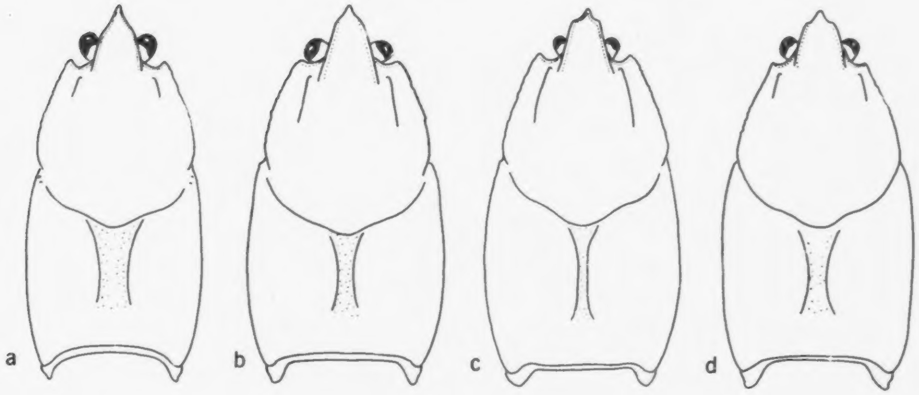

Fig. 100. Dorsal view of carapaces. a, *Cambarus unestami*; b, *C. latimanus*; c, *C. striatus*; d, *C. sphenoides*.

8(6) Areola less than 12 times longer than broad (Fig. 100b; see also Figs 89o, 90e, 92b):

Cambarus (D.) latimanus (LeConte, 1856)

(Lotic habitats from the Pamilico River system in North Carolina to the Alabama River system in Alabama, chiefly in the piedmont, but extending into western Florida along the Apalachicola River; also in southeastern Tennessee. Literature: Hobbs, 1942b, 1969b)

Areola more than 12 times longer than broad (Fig. 100c).. 9

9(8) First pleopod with subsetiform central projection, its apex directed proximally (Fig. 97e):
Cambarus (D.) reduncus Hobbs, 1956
(Lentic and lotic habitats and burrows in the piedmont from the Neuse River system in North Carolina to the Santee River system in South Carolina. Literature: Hobbs, 1956b, 1969b)

First pleopod with bladelike central projection, its apex directed caudoproximally (Fig. 98a-c)................10

10(9) Central projection of first pleopod extending as far or farther caudad than mesial process (Fig. 98a; see also Fig. 100c): *Cambarus (D.) striatus* Hay, 1902
(Lentic and lotic habitats and burrows from the Cumberland River system in Kentucky and Tennessee southward to Mississippi and Alabama. The range cited includes a species complex including at least 2, and probably 3, species or subspecies. Literature: Rhoades, 1944a; Hobbs, 1969b)

Central projection of first pleopod not extending so far caudad as mesial process (Fig. 98b,c)................ 11

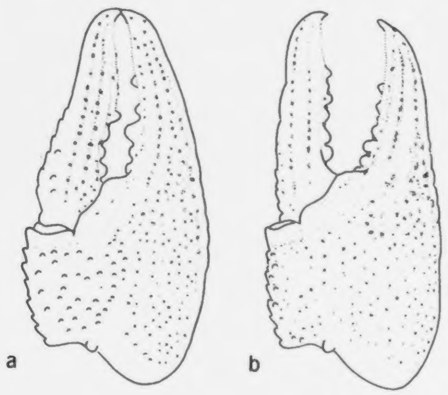

Fig. 101. Dorsal view of chelae. a, *Cambarus sphenoides*; b, *C. unestami*.

11(10) Color red; central projection of first pleopod longer than cephalocaudal plane of shaft at base of projection; gap between apex of mesial process and that of central projection less than height of projection at midlength (Fig. 98b): *Cambarus (D.) floridanus* Hobbs, 1941 (Burrows from the Yellow to the Ochlockonee river drainages in southern Alabama and Georgia, and Florida. Literature: Hobbs, 1942b; Hobbs and Hart, 1959)

Color brown; central projection of first pleopod subequal to or shorter than cephalocaudal plane of shaft at base of projection; gap between apex of mesial process and that of central projection distinctly greater than height of projection at midlength (Fig. 98c):

Cambarus (D.) catagius Hobbs and Perkins, 1967 (Burrows in Guilford County, North Carolina. Literature: Hobbs and Perkins, 1967; Hobbs, 1969b)

Key to Species of Subgenus *Erebicambarus*

1 Rostrum with marginal spines or tubercles (Fig. 102a)....... 2
Rostrum lacking marginal spines or tubercles (Fig. 102b-d).. 4

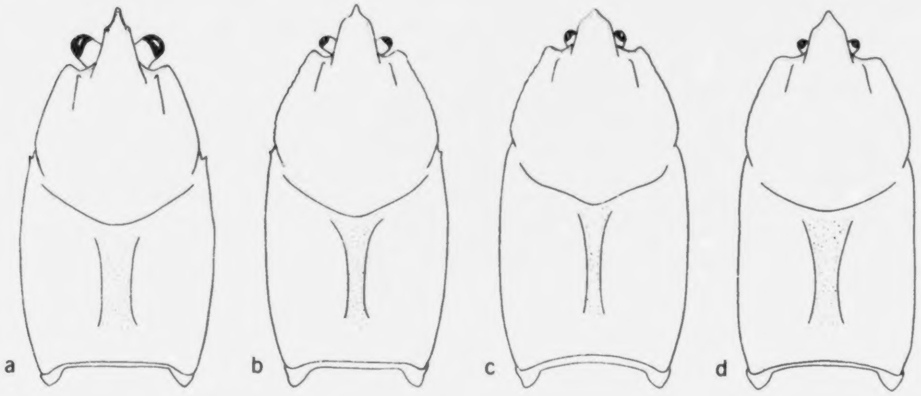

Fig. 102. Dorsal view of carapaces. a, *Cambarus rusticiformis;* b, *C. tenebrosus;* c, *C. laevis;* d, *C. cahni.*

2(1) Cervical spines absent (Fig. 91b):
Cambarus (E.) hubbsi Creaser, 1931
(Lotic habitats from the Meramec River system to the Eleven Point system in Missouri and Arkansas. Literature: Williams, 1954a)
Cervical spines present (Fig. 102a,b)...................... 3

3(2) Areola less than 7 times longer than broad; rostrum usually with slightly concave lateral margins (Fig. 102a; see also Fig. 89d,g): *Cambarus (E.) rusticiformis* Rhoades, 1944
(Lotic habitats in the Cumberland River system in Kentucky and Tennessee. Literature: Rhoades, 1944a; Hobbs, 1969b)
Areola more than 7 times longer than broad; rostrum with straight convergent margins (Fig. 102b; see also Fig. 103 b,d): *Cambarus (E.) tenebrosus* Hay, 1902
(Lotic epigean and subterranean habitats from the Ohio River - below confluence with Salt River - southward to the Tennessee River in Alabama, and eastward on the Cumberland Plateau. Literature: Rhoades, 1944a; Hobbs, 1969b)

4(1) Albinistic; length of mesial margin of palm of chela distinctly greater than width of palm (Fig. 103a; see also Fig. 10d):
Cambarus (E.) hubrichti Hobbs, 1952
(Subterranean waters of the White River basin in Carter, Oregon, and Ripley counties, Missouri. Literature: Hobbs and Barr, 1960)
Pigmented; length of mesial margin of palm of chela subequal to, or distinctly less than, width of palm (Fig. 103b,c).. 5

5(4) Areola 7 to 8 times longer than broad (Fig. 102d):
Cambarus (E.) cahni Rhoades, 1941
(Lotic epigean and subterranean habitats in northern Alabama. The relationship of this species to *C. tenebrosus*, of which it may be a subspecies or a synonym, is uncertain. Literature: Rhoades, 1941b; Hobbs and Barr, 1960)
Areola more than 8 times longer than broad (Fig. 102b,c)..... 6

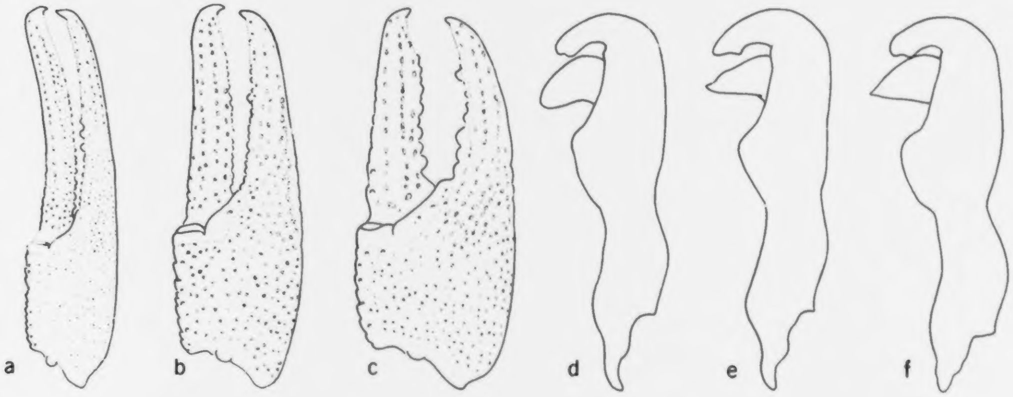

Fig. 103. a-c, Dorsal view of chelae; d-f, Lateral view of left first pleopods. a, *Cambarus hubrichti*; b, *C. tenebrosus*; c, *C. laevis*; d, *C. tenebrosus*; e, *C. laevis*; f, *C. ornatus*.

6(5) Areola with at least 4 punctations across narrowest part (Fig. 102b); mesial process of first pleopod broadly rounded distally (Fig. 103d; see also Fig. 103b):
Cambarus (E.) tenebrosus Hay, 1902
(See couplet 3 for range and literature)
Areola with no more than 3 punctations across narrowest part (Fig. 102c); mesial process of first pleopod strongly tapered, often subacute (Fig. 103e,f).................... 7

7(6) First pleopod with least diameter of gap between mesial process and central projection at least 1/3 of least height of latter (Fig. 103e; see also Figs 102c, 103c): *Cambarus (E.) laevis* Faxon, 1914 (Lotic epigean and subterranean habitats in southern Illinois and Indiana, southwestern Ohio, and northern Kentucky, in the Ohio River drainage. Literature: Faxon, 1914; Hobbs, 1969b)

First pleopod with least diameter of gap between mesial process and central projection much less than 1/3 least height of latter (Fig. 103f): *Cambarus (E.) ornatus* Rhoades, 1944 (Lotic habitats from the lower Kentucky River system to the Salt River, Kentucky. It seems likely that this species intergrades with *C. tenebrosus*. Literature: Rhoades, 1944a; Hobbs, 1969b)

Key to Species of Subgenus *Hiaticambarus*

1 Rostrum with marginal spines or tubercles (Fig. 104a; see also Fig. 89c): *Cambarus (H.) girardianus* Faxon, 1884 (Lotic habitats in the Tennessee River drainage system in Alabama, Mississippi, Tennessee, and Georgia. This species may prove to be conspecific with *C. (H.) longirostris*. Literature: Faxon, 1884; Hobbs, 1969b)

Rostrum without marginal spines or tubercles (Fig. 104b).... 2

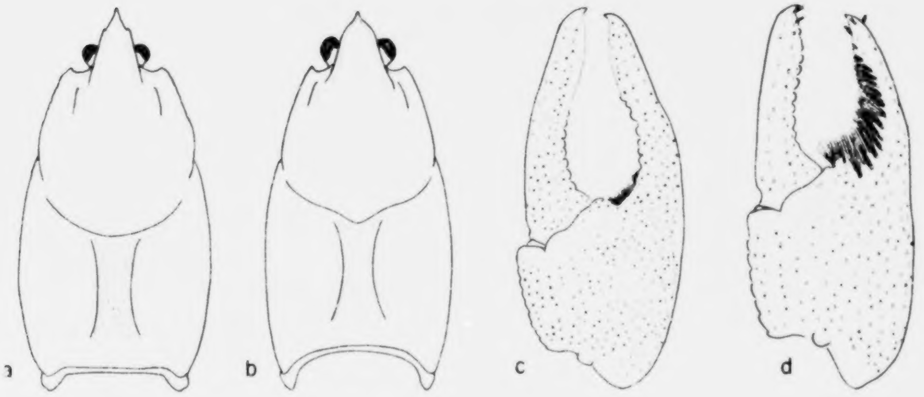

Fig. 104. a,b, Dorsal view of carapaces; c,d, Dorsal view of chelae. a, *C. girardianus*; b, *C. longirostris*; c, *C. chasmodactylus*; d, *C. longulus*.

2(1) Suborbital angle acute (Fig. 105a; see also Fig. 104b): *Cambarus (H.) longirostris* Faxon, 1885 (Lotic habitats in the Tennessee River system from Lawrence County, Tennessee, to southwestern Virginia, and in the Coosa River system in northeastern Alabama and northwestern Georgia. Literature: James, 1966; Hobbs, 1969b)

Suborbital angle obtuse or obsolete (Fig. 105b)............. 3

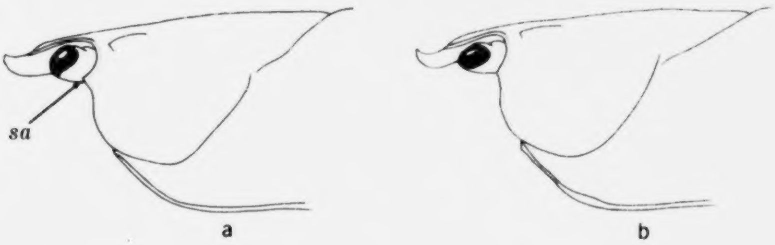

Fig. 105. Lateral view of cephalic region. a, *Cambarus longirostris*; b, *C. chasmodactylus*. (*sa*, suborbital angle.)

3(2) Dactyl of chela more than twice as long as mesial margin of palm (Fig. 104c; see also Fig. 105b): *Cambarus (H.) chasmodactylus* James, 1966 (Lotic habitats in the New (Kanawha) River system in North Carolina, Virginia, and southeastern West Virginia. Literature: James, 1966; Hobbs, 1969b)

Dactyl of chela less than twice as long as mesial margin of palm (Fig. 104d): *Cambarus (H.) longulus* Girard, 1852 (Lotic habitats from the James River drainage in Virginia, to the Yadkin River drainage in North Carolina, in the mountains and piedmont. Literature: James, 1966; Hobbs, 1969b)

Key to Species of Subgenus *Jugicambarus*

1 Central projection of first pleopod with subapical notch (Fig. 106a-c,e,*n*).. 2
Central projection of first pleopod lacking subapical notch (Figs 106d, 109).. 7

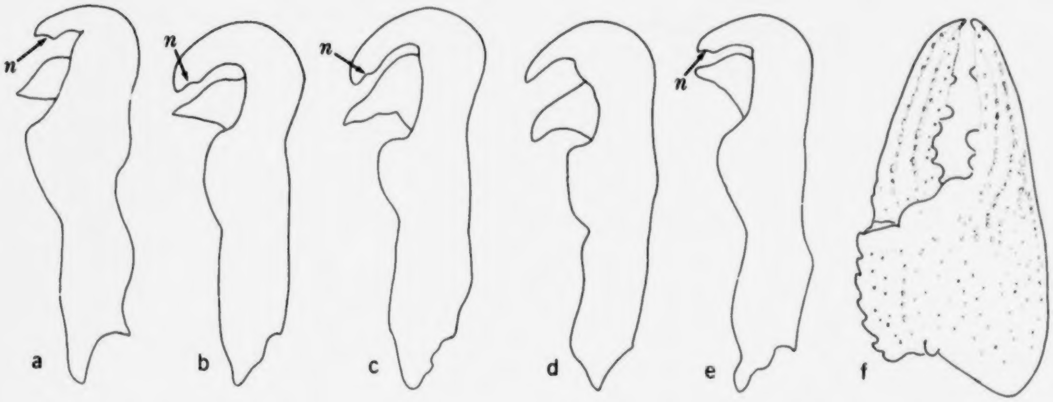

Fig. 106. a-e, Lateral view of left first pleopods; f, Dorsal view of chelae. a, *Cambarus distans*; b, *C. parvoculus*; c, *C. conasaugaensis*; d, *C. zophonastes*; e, *C. monongalensis*, f, *C. carolinus*. (*n*, subapical notch.)

2(1) Albinistic; eyes reduced and without pigment................ 3
Pigmented; eyes well developed and with pigment............. 4

3(2) Rostrum with marginal spines or tubercles (Fig. 107a; see also Figs 10c, 87b): *Cambarus (J.) setosus* Faxon, 1889 (Subterranean waters of southwestern Missouri and perhaps in northeastern Oklahoma. Literature: Hobbs and Barr, 1960; Hobbs, 1969b)
Rostrum lacking marginal spines or tubercles (Fig. 107b; see also Fig. 10e): *Cambarus (J.) cryptodytes* Hobbs, 1941 (Subterranean waters from Jackson County, Florida, to Decatur County, Georgia. Literature: Hobbs and Barr, 1960)

4(2) Areola at least 8 times longer than broad (Fig. 107c; see also Fig. 106e); color blue:
Cambarus (J.) monongalensis Ortmann, 1905
(Burrows in the mountains of western Pennsylvania and adjacent northern West Virginia. Literature: Ortmann, 1906, 1931; Hobbs, 1969b)

Areola less than 8 times longer than broad (Figs 107d, 108a,b); color reddish to greenish brown........................ 5

5(4) Central projection of first pleopod directed approximately at right angle to shaft of appendage (Fig. 106a; see also Fig. 107d): *Cambarus (J.) distans* Rhoades, 1944
(Lotic habitats on the Cumberland Plateau in the Cumberland River drainage system in Kentucky and Tennessee. Literature: Rhoades, 1944a)

Central projection of first pleopod strongly recurved caudoproximally (Fig. 106b,c).............................. 6

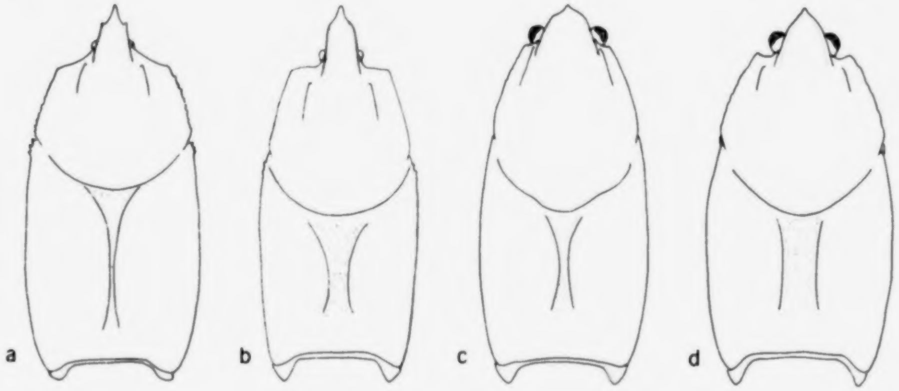

Fig. 107. Dorsal view of carapaces. a, *Cambarus setosus*; b, *C. cryptodytes*; c, *C. monongalensis*; d, *C. distans*.

6(5) Areola at least 5.5 times longer than broad (Fig. 108a; see also Fig. 106b):
Cambarus (J.) parvoculus Hobbs and Shoup, 1947
(Lotic habitats in the upper Cumberland River drainage in Kentucky and Tennessee, and the Tennessee River drainage in Lee County, Virginia. Literature: Hobbs and Shoup, 1947; Hobbs, 1969b)

Areola less than 5.5 times longer than broad (Fig. 108b; see also Fig. 106c):
Cambarus (J.) conasaugaensis Hobbs and Hobbs, 1962
(Lotic habitats in the Conasauga and Coosawattee river systems in Tennessee and Georgia. Literature: Hobbs and Hobbs, 1962; Hobbs, 1969b)

7(1) Albinistic; eyes reduced and without pigment (See Fig. 106d):
Cambarus (J.) zophonastes Hobbs and Bedinger, 1964
(Subterranean water in Hell Creek Cave, Stone County, Arkansas. Literature: Hobbs and Bedinger, 1964; Hobbs, 1969b)

Pigmented; eyes well developed and with pigment............ 8

8(7) Areola narrow, with no more than 1 punctation in narrowest part (Fig. 108c); chelae not conspicuously setose (Fig. 106f).. 9

Areola broad to moderately broad, with room for 3 or more punctations across narrowest part (Fig. 108d,e); chelae conspicuously setose (Fig. 8e).........................11

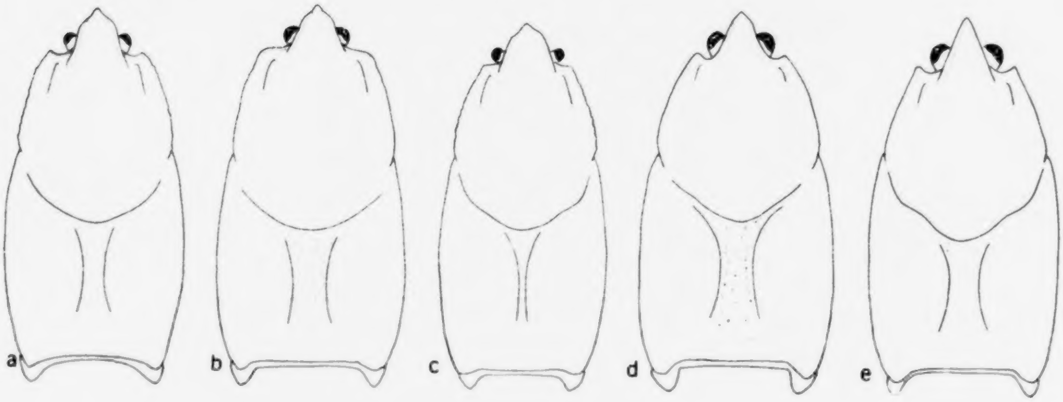

Fig. 108. Dorsal view of carapaces. a, *Cambarus parvoculus*; b, *C. conasaugaensis*; c, *C. carolinus*; d, *C. friaufi*; e, *C. brachydactylus*.

9(8) Central projection of first pleopod extending caudad much farther than mesial process (Fig. 109a):
Cambarus (J.) causeyi Reimer, 1966
(Burrows near a spring and natural pond, 4 miles west of Sandgap, Pope County, Arkansas, on St. Rte. 124. Literature : Reimer, 1966; Hobbs, 1969b)

Central projection of first pleopod extending little, if any, farther caudad than mesial process (Fig. 109b-f)........ 10

10(9) First pleopod with adjacent margins of terminal elements subparallel (Fig. 109b); color blue and yellow:

Cambarus (J.) gentryi Hobbs, 1970

(Burrows along the Cumberland (Stones River, Harpeth River, and Yellow Creek) and Duck drainage systems in middle Tennessee. Literature: Hobbs, 1970a)

First pleopod with adjacent margins of terminal elements diverging (Fig. 109c; see also Figs 106f, 108c); color red to orange or blue with red to orange markings:

Cambarus (J.) carolinus (Erichson, 1846)

(Burrows in the mountains and foothills from Kentucky and Pennsylvania to Georgia and South Carolina. (Almost certainly, there are several species or subspecies currently assigned to *C. carolinus,* including *C. dubius* Faxon, 1884. Literature: Faxon, 1885; Hobbs, 1969b)

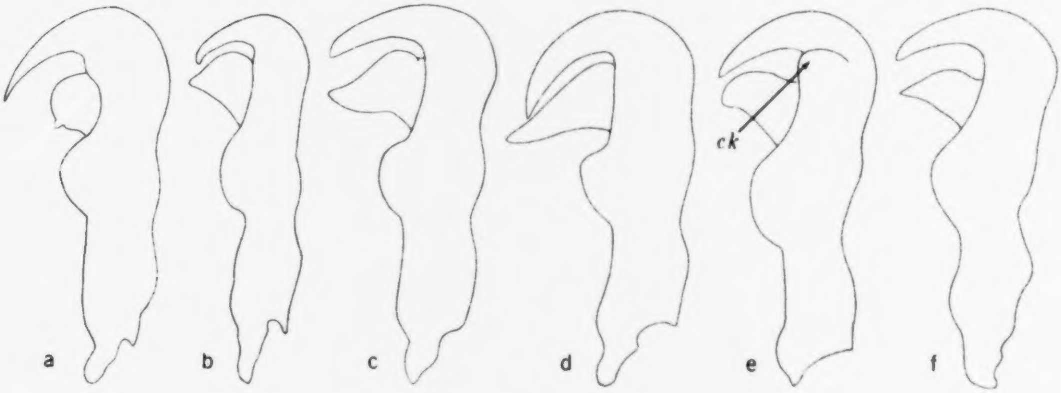

Fig. 109. Lateral view of left first pleopods. a, *Cambarus causeyi*; b, *C. gentryi*; c, *C. carolinus*; d, *C. asperimanus*; e, *C. friaufi*; f, *C. brachydactylus*. (*ck*, caudal knob.)

11(8) Central projection of first pleopod strongly recurved proximocaudally, tip extending proximal to distal base of mesial process and not projecting so far caudad as latter (Fig. 109d; see also Fig. 89e,i):

Cambarus (J.) asperimanus Faxon, 1914

(Lotic habitats in the headwater streams from the French Broad, Little Tennessee, Savannah, Saluda, Catawba, and Broad rivers in Georgia, North Carolina, South Carolina, and Tennessee. Literature: Faxon, 1914; Hobbs, 1969b)

Central projection of first pleopod recurved at not much more than right angle to principal shaft of appendage, not extending proximal to distal base of mesial process and projecting caudad as far as latter (Fig. 109e,f)....... 12

12(11) Areola with comparatively few punctations; caudolateral surface of first pleopod with prominent lobelike caudal knob at caudolateral base of central projection (Fig. 109e; see also Fig. 108d): *Cambarus (J.) friaufi* Hobbs, 1953 (Lotic habitats on the Eastern Highland Rim (Cumberland River drainage), Tennessee. Literature: Hobbs, 1953a, 1969b)

Areola with many punctations; caudolateral surface of first pleopod lacking prominent lobelike caudal knob at caudolateral base of central projection (Fig. 109f; see also Figs 8e, 108e): *Cambarus (J.) brachydactylus* Hobbs, 1953 (Lotic habitats in tributaries of the Cumberland River on the western Highland Rim in Tennessee. Literature: Hobbs, 1953a, 1969b)

Key to Species of Subgenus *Lacunicambarus*
(Based on Marlow, 1960)

1 Cephalic section of carapace at least 1.4 times longer than areola (Fig. 110a; see also Figs 89n, 90d, 92a):
Cambarus (L.) diogenes diogenes Girard, 1852
(Burrows, occasionally in streams and ponds; widespread east of the Rocky Mountains, and from the Great Lakes region southward except in higher mountains and in peninsular Florida. This is unquestionably a species complex. Literature: Marlow, 1960; Hobbs, 1969b)

Cephalic section of carapace no more than 1.3 times longer than areola (Fig. 110b):
Cambarus (L.) diogenes ludovicianus Faxon, 1884
(Burrows in southern Louisiana. The range has never been satisfactorily established, and its relation to the nominate species is obscure. Literature: Marlow, 1960; Hobbs, 1969b)

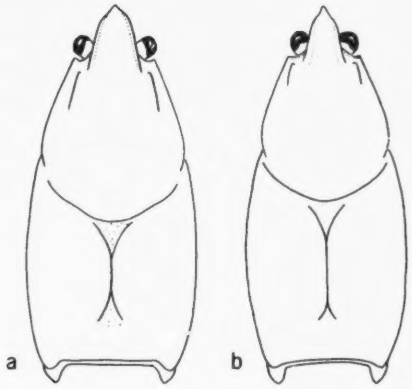

Fig. 110. Dorsal view of carapaces. a, *Cambarus d. diogenes*; b, *C. diogenes ludovicianus*.

Key to Species of Subgenus *Puncticambarus*

1 Rostrum with marginal spines or tubercles (Fig. 111a-c)..... 2
Rostrum without marginal spines or tubercles (Fig. 111d).... 4

2(1) Hepatic region of carapace with 1 or more spines (Fig. 111a):
Cambarus (P.) spicatus Hobbs, 1956
(Lotic habitats in the Little River drainage system in Fairfield and Richland counties, South Carolina. Literature: Hobbs, 1956c, 1969b)
Hepatic region of carapace usually with tubercles but always lacking spines (Fig. 111b,c)............................. 3

3(2) Areola comprising more than 36 per cent of total length of carapace (Fig. 111b; see also Fig. 90c):
Cambarus (P.) nerterius Hobbs, 1964
(Subterranean waters in the Greenbrier River drainage in West Virginia. Literature: Hobbs, 1964, 1969b)
Areola comprising less than 36 per cent of total length of carapace (Fig. 111c; see also Fig. 90b):
Cambarus (P.) extraneus Hagen, 1870
(Lotic habitats in the Tennessee River drainage system in Georgia. Literature: Hagen, 1870; Hobbs, 1969b)

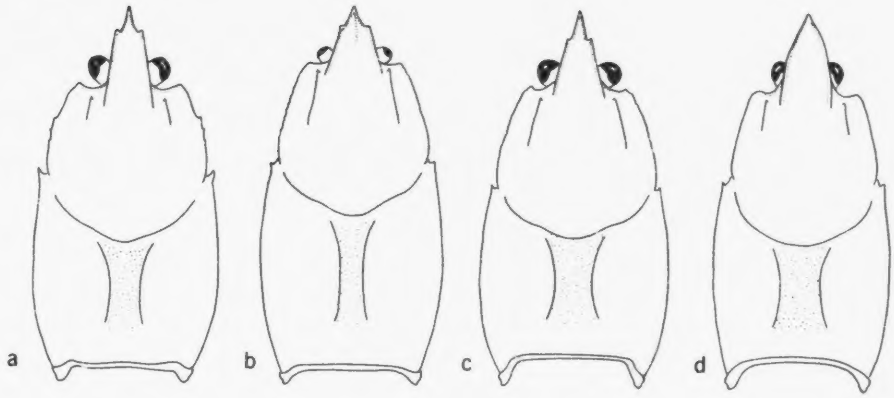

Fig. 111. Dorsal view of carapaces. a, *Cambarus spicatus*; b, *C. nerterius*; c, *C. extraneus*; d, *C. reburrus*.

4(1) Areola less than 3.5 times longer than broad (Fig. 111d); fingers of chelae distinctly pubescent dorsally (Fig. 112a): *Cambarus (P.) reburrus* Prins, 1968 (Lotic habitats in the headwaters of the French Broad and Savannah rivers in North Carolina. Literature: Prins, 1968; Prins and Hobbs, 1972)

Areola more than 3.5 times longer than broad; fingers not conspicuously pubescent dorsally (Fig. 112b,c)............ 5

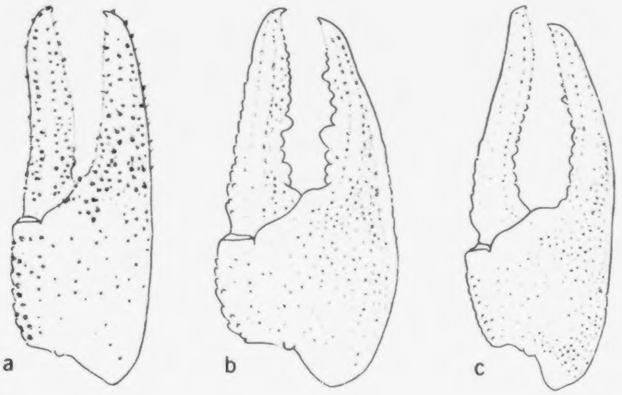

Fig. 112. Dorsal view of chelae. a, *Cambarus reburrus*; b, *C. acuminatus*; c, *C. veteranus*.

5(4) Width of palm of chela less than 1.5 times length of its mesial margin (Fig. 112c): *Cambarus (P.) veteranus* Faxon, 1914 (Lotic habitats in the Guyandot drainage system in southern West Virginia; also in eastern Kentucky. The limits of the range are not known. Literature: Faxon, 1914; Hobbs, 1969b)

Width of palm of chela more than 1.5 times length of its mesial margin (Fig. 112b)...................................... 6

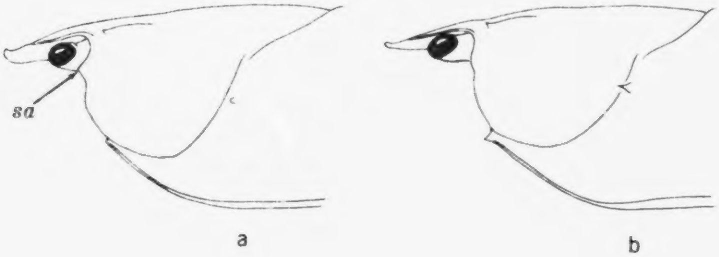

Fig. 113. Lateral view of cephalic region. a, *Cambarus robustus*; b, *C. acuminatus* (*sa*, suborbital angle.)

6(5) Suborbital angle (*sa*) present (Fig. 113a; see also Fig. 89m):
Cambarus (P.) robustus Girard, 1852
(Lotic habitats from Ontario and New York to Illinois and southward to Tennessee, North Carolina, and Virginia. Populations in the Atlantic watershed from Maryland to South Carolina that are currently assigned to *C. acuminatus* probably represent one or more undescribed species or subspecies. Literature: Crocker and Barr, 1968; Hobbs, 1969b)

Suborbital angle absent (Fig. 113b; see also Fig. 112b):
Cambarus (P.) acuminatus Faxon, 1884
(Lotic habitats in the Atlantic watershed from Maryland to the Saluda River drainage, South Carolina. This is a species complex and needs revision. See the statement under *C. robustus* in this couplet. Literature: Faxon, 1885; Hobbs, 1969b).

Key to Species of Subgenus *Veticambarus*

1 Chela studded with setae and mesial margin of palm longer than maximum width of chela (Fig. 114a); areola less than 2.5 times longer than broad (Fig. 114c); first pleopod with prominent caudal knob (Fig. 115a):

Cambarus (V.) pristinus Hobbs, 1965
(Lotic habitats in the Caney Fork River drainage in Cumberland County, Tennessee. Literature: Hobbs, 1965, 1969b)

Chela not markedly setose and mesial margin of palm shorter than maximum width of chela (Fig. 114b); areola more than 2.5 times longer than broad (Fig. 114d); first pleopod with caudal knob vestigial or absent (Fig. 115b,c)....... 2

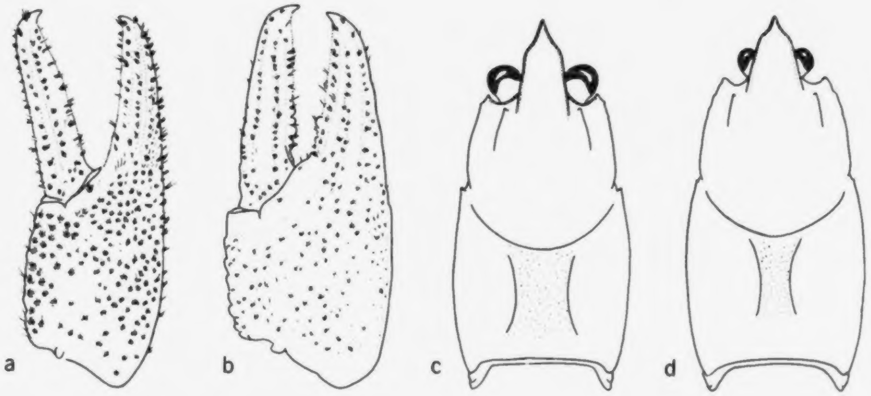

Fig. 114. a,b, Dorsal view of chelae; c,d, Dorsal view of carapaces. a, *Cambarus pristinus*; b, *C. bouchardi*; c, *C. pristinus*; d, *C. obeyensis*.

2(1) First pleopod with central projection directed at angle less than 30 degrees to axis of main shaft of appendage; mesial process reaching as far, or almost as far, distally (along principal axis of appendage) as does central projection (Fig. 115b; see also Fig. 114b):

Cambarus (V.) bouchardi Hobbs, 1970
(Lotic habitats in the Big South Fork of the Cumberland River in Scott County, Tennessee. Literature: Hobbs, 1970b)

First pleopod with central projection directed at angle greater than 60 degrees to axis of main shaft of appendage; mesial process not reaching nearly so far distally (along principal axis of appendage) as does central projection (Fig. 115c; see also Fig. 114d):

Cambarus (V.) obeyensis Hobbs and Shoup, 1947
(Lotic habitats in the headwaters of the Obey River in Tennessee. Literature: Hobbs and Shoup, 1947; Hobbs, 1969b)

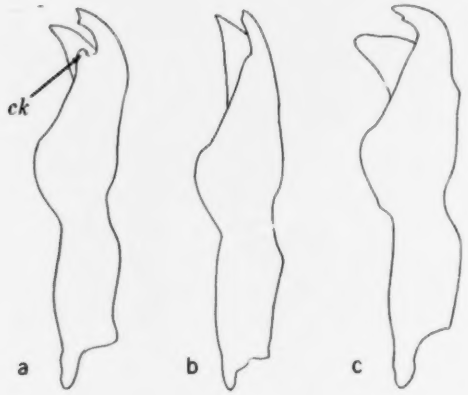

Fig. 115. Lateral view of pleopods. a, *Cambarus pristinus*; b, *C. bouchardi*; c, *C. obeyensis*. (*ck*, caudal knob.)

SECTION III

ACKNOWLEDGEMENTS

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APPENDIX I

Alphabetical List of North American and Middle American Crayfishes (Astacidae) and the States and Provinces in which They Occur

Subfamily Astacinae

Pacifastacus

1. *connectens* - U.S.: Idaho, Oregon
2. *fortis* - U.S.: California
3. *gambelii* - U.S.: California?, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming
4. *leniusculus klamathensis* - CANADA: British Columbia.--U.S.: California, Idaho, Oregon, Washington
5. *leniusculus leniusculus* - CANADA: British Columbia.-- U.S.: California, Idaho, Nevada, Oregon, Washington, (Sweden)
6. *leniusculus trowbridgii* - CANADA: British Columbia.-- U.S.: California, Idaho, Nevada, Oregon, Washington
7. *nigrescens* - U.S.: California

Subfamily Cambarellinae

Cambarellus

8. *alvarezi* - MEXICO: Nuevo León
9. *areolatus* - MEXICO: Coahuila
10. *chapalanus* - MEXICO: Jalisco, Michoacán
11. *diminutus* - U.S.: Alabama, Mississippi
12. *montezumae* - MEXICO: Distrito Federal, Guanajuato, Jalisco, México, Michoacán
13. *ninae* - U.S.: Texas
14. *occidentalis* - MEXICO: Michoacán, Sinaloa
15. *patzcuarensis* - MEXICO: Michoacán
16. *puer* - U.S.: Arkansas, Louisiana, Mississippi, Tennessee, Texas
17. *schmitti* - U.S.: Alabama, Florida
18. *shufeldtii* - U.S.: Alabama, Arkansas, Illinois, Louisiana, Mississippi, Tennessee, Texas
19. *zempoalensis* - MEXICO: Morelos

Subfamily Cambarinae

Cambarus

20. *acuminatus* - U.S.: Maryland, North Carolina, South Carolina, Virginia
21. *asperimanus* - U.S.: Georgia, North Carolina, South Carolina, Tennessee

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Cambarus (continued)

22. *bartonii bartonii* - CANADA: New Brunswick, Ontario, Quebec.-- U.S.: Connecticut, District of Columbia, Georgia, Kentucky, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia
23. *bartonii carinirostris* - U.S.: West Virginia
24. *bartonii cavatus* - U.S.: Alabama, Georgia, North Carolina, Tennessee, Virginia
25. *bouchardi* - U.S.: Tennessee
26. *brachydactylus* - U.S.: Tennessee
27. *cahni* - U.S.: Alabama
28. *carolinus* - U.S.: Georgia, Kentucky, Maryland, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia
29. *catagius* - U.S.: North Carolina
30. *causeyi* - U.S.: Arkansas
31. *chasmodactylus* - U.S.: North Carolina, Virginia, West Virginia
32. *conasaugaensis* - U.S.: Georgia, Tennessee
33. *cornutus* - U.S.: Kentucky
34. *cryptodytes* - U.S.: Florida, Georgia
35. *cymatilis* - U.S.: Georgia
36. *diogenes diogenes* - CANADA: Ontario.-- U.S.: Alabama, Arkansas, Colorado, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia, Wisconsin, Wyoming
37. *diogenes ludovicianus* - U.S.: Arkansas?, Louisiana, Mississippi?, Oklahoma?, Tennessee?, Texas?
38. *distans* - U.S.: Kentucky, Tennessee
39. *extraneus* - U.S.: Georgia
40. *floridanus* - U.S.: Alabama, Florida, Georgia
41. *friaufi* - U.S.: Tennessee
42. *gentryi* - U.S.: Tennessee
43. *girardianus* - U.S.: Alabama, Georgia, Mississippi?, Tennessee
44. *halli* - U.S.: Alabama, Georgia
45. *hamulatus* - U.S.: Alabama, Tennessee
46. *howardi* - U.S.: Georgia
47. *hubbsi* - U.S.: Arkansas, Missouri
48. *hubrichti* - U.S.: Missouri
49. *jonesi* - U.S.: Alabama
50. *jordani* - U.S.: Alabama, Georgia
51. *laevis* - U.S.: Illinois, Indiana, Kentucky, Ohio, West Virginia?
52. *latimanus* - U.S.: Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee
53. *longirostris* - U.S.: Alabama, Georgia, North Carolina, Tennessee, Virginia

Cambarus (continued)

54. *longulus* - U.S.: North Carolina, Virginia
55. *monongalensis* - U.S.: Pennsylvania, West Virginia
56. *nerterius* - U.S.: West Virginia
57. *obeyensis* - U.S.: Tennessee
58. *obstipus* - U.S.: Alabama
59. *ornatus* - U.S.: Kentucky
60. *ortmanni* - U.S.: Indiana, Kentucky, Ohio
61. *parvoculus* - U.S.: Kentucky, Tennessee, Virginia
62. *pristinus* - U.S.: Tennessee
63. *reburrus* - U.S.: North Carolina
64. *reduncus* - U.S.: North Carolina, South Carolina
65. *robustus* - CANADA: Ontario.-- U.S.: Illinois, Indiana, Kentucky, Michigan, New York, North Carolina, Ohio, Pennsylvania, West Virginia
66. *rusticiformis* - U.S.: Kentucky, Tennessee
67. *sciotensis* - U.S.: Ohio, Virginia, West Virginia
68. *setosus* - U.S.: Missouri, Oklahoma?
69. *sphenoides* - U.S.: Alabama, Kentucky, Tennessee
70. *spicatus* - U.S.: South Carolina
71. *striatus* - U.S.: Alabama?, Georgia?, Kentucky, Tennessee, Mississippi?
72. *tenebrosus* - U.S.: Alabama, Kentucky, Tennessee
73. *unestami* - U.S.: Georgia
74. *veteranus* - U.S.: Kentucky, West Virginia
75. *zophonastes* - U.S.: Arkansas

Fallicambarus

76. *byersi* - U.S.: Alabama, Florida, Mississippi
77. *dissitus* - U.S.: Louisiana
78. *fodiens* - CANADA: Ontario.-- U.S.: Alabama, Arkansas, Georgia, Illinois, Indiana, Michigan, Mississippi?, Ohio, Tennessee
79. *hedgpethi* - U.S.: Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, Texas
80. *hortoni* - U.S.: Tennessee
81. *macneesei* - U.S.: Louisiana
82. *oryktes* - U.S.: Louisiana, Mississippi
83. *strawni* - U.S.: Arkansas
84. *uhleri* - U.S.: Maryland, North Carolina, South Carolina, Virginia

Faxonella

85. *beyeri* - U.S.: Louisiana
86. *clypeata* - U.S.: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, Texas
87. *creaseri* - U.S.: Louisiana

Hobbseus

88. *attenuatus* - U.S.: Mississippi
89. *cristatus* - U.S.: Mississippi
90. *orconectoides* - U.S.: Mississippi
91. *prominens* - U.S.: Alabama, Mississippi
92. *valleculus* - U.S.: Mississippi

Orconectes

93. *acares* - U.S.: Arkansas
94. *alabamensis* - U.S.: Alabama, Mississippi, Tennessee
95. *australis australis* - U.S.: Alabama, Tennessee
96. *australis packardi* - U.S.: Kentucky
97. *barrenensis* - U.S.: Kentucky, Tennessee
98. *bisectus* - U.S.: Kentucky
99. *compressus* - U.S.: Alabama, Kentucky, Mississippi, Tennessee
100. *difficilis* - U.S.: Arkansas, Louisiana, Oklahoma, Texas
101. *erichsonianus* - U.S.: Alabama, Georgia, Tennessee, Virginia
102. *eupunctus* - U.S.: Arkansas, Missouri
103. *forceps* - U.S.: Alabama, Georgia, Tennessee, Virginia
104. *harrisoni* - U.S.: Missouri
105. *hathawayi* - U.S.: Louisiana
106. *hobbsi* - U.S.: Louisiana, Mississippi
107. *hylas* - U.S.: Missouri
108. *illinoiensis* - U.S.: Illinois
109. *immunis* - CANADA: Ontario.-- U.S.: Alabama, Colorado, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New York, North Dakota, Ohio, South Dakota, Tennessee, Wisconsin, Wyoming
110. *incomptus* - U.S.: Tennessee
111. *indianensis* - U.S.: Illinois, Indiana
112. *inermis inermis* - U.S.: Indiana, Kentucky
113. *inermis testii* - U.S.: Indiana
114. *iowaensis* - U.S.: Iowa
115. *jeffersoni* - U.S.: Kentucky
116. *juvenilis* - U.S.: Indiana?, Kentucky, North Carolina?, Ohio, Tennessee?, Virginia?, West Virginia?
117. *kentuckiensis* - U.S.: Illinois, Kentucky
118. *lancifer* - U.S.: Arkansas, Illinois, Louisiana, Mississippi, Tennessee, Texas
119. *leptogonopodus* - U.S.: Arkansas, Oklahoma
120. *limosus* - U.S.: Delaware, District of Columbia, Maine, Maryland, Massachusetts, New York, Pennsylvania, Virginia, West Virginia, (Western Europe)
121. *longidigitus* - U.S.: Arkansas, Missouri
122. *luteus* - U.S.: Arkansas, Kansas, Missouri
123. *macrus* - U.S.: Arkansas, Missouri
124. *marchandi* - U.S.: Arkansas, Missouri
125. *medius* - U.S.: Missouri

Orconectes (continued)

126. *meeki brevis* - U.S.: Arkansas, Oklahoma
127. *meeki meeki* - U.S.: Arkansas
128. *menae* - U.S.: Arkansas, Oklahoma
129. *mirus* - U.S.: Alabama, Tennessee
130. *mississippiensis* - U.S.: Alabama, Mississippi
131. *nais* - U.S.: Arkansas, Kansas, Missouri, Oklahoma, Texas
132. *nana* - U.S.: Arkansas, Oklahoma
133. *neglectus chaenodactylus* - U.S.: Arkansas, Missouri
134. *neglectus neglectus* - U.S.: Arkansas, Colorado, Kansas, Missouri, Nebraska?, Oklahoma, Texas
135. *obscurus* - CANADA: Ontario.-- U.S.: Maryland, New York, Ohio, Pennsylvania, Virginia, West Virginia
136. *ozarkae* - U.S.: Arkansas, Missouri
137. *palmeri creolanus* - U.S.: Louisiana, Mississippi
138. *palmeri longimanus* - U.S.: Arkansas, Kansas, Louisiana, Oklahoma, Texas
139. *palmeri palmeri* - U.S.: Arkansas, Louisiana, Mississippi, Missouri, Tennessee
140. *pellucidus* - U.S.: Kentucky, Tennessee
141. *peruncus* - U.S.: Missouri
142. *placidus* - U.S.: Alabama, Kentucky, Tennessee
143. *propinquus* - CANADA: Ontario, Quebec.-- U.S.: Illinois, Indiana, Michigan, New York, Ohio, Pennsylvania, Wisconsin
144. *punctimanus* - U.S.: Arkansas, Missouri
145. *putnami* - U.S.: Indiana?, Kentucky, Tennessee?
146. *quadruncus* - U.S.: Missouri
147. *rafinesquei* - U.S.: Kentucky
148. *rhoadesi* - U.S.: Tennessee
149. *rusticus* - CANADA: Ontario.-- U.S.: Illinois, Indiana, Iowa?, Kentucky, Maine, Massachusetts, Michigan, New Mexico?, Ohio
150. *sanborni erismophorous* - U.S.: West Virginia
151. *sanborni sanborni* - U.S.: Kentucky, Ohio, West Virginia
152. *shoupi* - U.S.: Tennessee
153. *sloanii* - U.S.: Indiana, Ohio
154. *spinosus* - U.S.: Alabama, Georgia, Tennessee, Virginia?, West Virginia?
155. *transfuga* - U.S.: Oregon
156. *tricuspis* - U.S.: Kentucky
157. *validus* - U.S.: Alabama, Tennessee
158. *virginiensis* - U.S.: North Carolina, Virginia
159. *virilis* - CANADA: Alberta, Manitoba, Ontario, Quebec, Saskatchewan.-- U.S.: Arizona, Arkansas, California, Colorado, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, Wisconsin, Wyoming
160. *williamsi* - U.S.: Arkansas
161. *wrighti* - U.S.: Tennessee

Procambarus

162. *ablusus* - U.S.: Mississippi, Tennessee
163. *acanthophorus* - MEXICO: Oaxaca, Veracruz
164. *acherontis* - U.S.: Florida
165. *acutissimus* - U.S.: Alabama, Mississippi
166. *acutus acutus* - U.S.: Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Wisconsin
167. *acutus cuevachicae* - MEXICO: Puebla, San Luis Potosí
168. *advena* - U.S.: Florida, Georgia
169. *alleni* - U.S.: Florida
170. *ancylus* - U.S.: North Carolina, South Carolina
171. *angustatus* - U.S.: Georgia
172. *apalachicolae* - U.S.: Florida
173. *atkinsoni* - CUBA: Isla de Pinos
174. *aztecus* - MEXICO: Veracruz
175. *barbatus* - U.S.: Georgia, South Carolina
176. *bivittatus* - U.S.: Alabama, Florida, Louisiana
177. *blandingii* - U.S.: North Carolina, South Carolina
178. *bouvieri* - MEXICO: Michoacán
179. *caballeroi* - MEXICO: Puebla
180. *capillatus* - U.S.: Alabama, Florida
181. *chacei* - U.S.: Georgia, South Carolina
182. *clarkii* - MEXICO: Chihuahua, Coahuila, Nuevo León, Sonora.--U.S.: Alabama, Arizona, Arkansas, California, Florida, Hawaii, Illinois, Kentucky, Louisiana, Mississippi, Missouri, Nevada, New Mexico, Oklahoma, Tennessee, Texas, Virginia, (Japan)
183. *contrerasi* - MEXICO: Puebla
184. *cubensis cubensis* - CUBA: Camagüey, Isla de Pinos, La Habana, Las Villas, Matanzas, Oriente, Pinar del Río
185. *cubensis rivalis* - CUBA: Pinar del Río
186. *digueti* - MEXICO: Jalisco, Michoacán
187. *dupratzi* - U.S.: Arkansas, Louisiana, Texas
188. *echinatus* - U.S.: South Carolina
189. *econfinae* - U.S.: Florida
190. *elegans* - U.S.: Louisiana
191. *enoplosternum* - U.S.: Georgia
192. *epicyrtus* - U.S.: Georgia
193. *erichsoni* - MEXICO: Hidalgo
194. *escambiensis* - U.S.: Alabama, Florida
195. *evermanni* - U.S.: Alabama, Florida, Mississippi
196. *fallax* - U.S.: Florida, Georgia
197. *fitzpatricki* - U.S.: Mississippi
198. *geodytes* - U.S.: Florida
199. *gibbus* - U.S.: Georgia
200. *gonopodocristatus* - MEXICO: Veracruz

Procambarus (continued)

201. *gracilis* - U.S.: Arkansas, Illinois, Iowa, Kansas, Missouri, Oklahoma, Texas, Wisconsin
202. *hagenianus* - U.S.: Alabama, Mississippi
203. *hayi* - U.S.: Alabama, Mississippi, Tennessee
204. *hinei* - U.S.: Louisiana, Texas
205. *hirsutus* - U.S.: South Carolina
206. *hoffmanni* - MEXICO: Puebla, Veracruz
207. *hortonhobbsi* - MEXICO: Puebla
208. *howellae* - U.S.: Georgia
209. *hubbelli* - U.S.: Alabama, Florida
210. *hybus* - U.S.: Alabama, Mississippi
211. *incilis* - U.S.: Texas
212. *jaculus* - U.S.: Louisiana, Mississippi
213. *kilbyi* - U.S.: Florida
214. *lagniappe* - U.S.: Mississippi
215. *latipleurum* - U.S.: Florida
216. *lecontei* - U.S.: Alabama, Mississippi
217. *leonensis* - U.S.: Florida
218. *lepidodactylus* - U.S.: North Carolina, South Carolina
219. *lewisi* - U.S.: Alabama
220. *litosternum* - U.S.: Georgia
221. *llamasi* - GUATEMALA.-- MEXICO: Campeche, Chiapas, Tabasco, Veracruz, Yucatán
222. *lophotus* - U.S.: Alabama, Georgia, Tennessee
223. *lucifugus alachua* - U.S.: Florida
224. *lucifugus lucifugus* - U.S.: Florida
225. *lunzi* - U.S.: Georgia, South Carolina
226. *lylei* - U.S.: Mississippi
227. *mancus* - U.S.: Mississippi
228. *mexicanus* - MEXICO: Veracruz
229. *milleri* - U.S. : Florida
230. *mirandai* - MEXICO: Chiapas
231. *natchitochae* - U.S.: Arkansas, Louisiana, Texas
232. *niveus* - CUBA: Pinar del Río
233. *okaloosae* - U.S.: Alabama, Florida
234. *ortmanni* - MEXICO: Puebla
235. *ouachitae* - U.S.: Arkansas, Mississippi
236. *paeninsulanus* - U.S.: Alabama, Florida, Georgia
237. *pallidus* - U.S.: Florida
238. *paradoxus* - MEXICO: Puebla
239. *pearsei pearsei* - U.S.: North Carolina, South Carolina
240. *pearsei plumimanus* - U.S.: North Carolina
241. *pecki* - U.S.: Alabama
242. *penni* - U.S.: Alabama, Louisiana, Mississippi
243. *pictus* - U.S.: Florida
244. *pilosimanus* - BRITISH HONDURAS.-- GUATEMALA.-- MEXICO: Chiapas, Quintana Roo
245. *planirostris* - U.S.: Louisiana, Mississippi
246. *pubescens* - U.S.: Georgia, South Carolina
247. *pubischelae* - U.S.: Florida, Georgia
248. *pycnogonopodus* - U.S.: Florida

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249. *pygmaeus* - U.S.: Florida, Georgia
250. *raneyi* - U.S.: Georgia, South Carolina
251. *rathbunae* - U.S.: Florida
252. *riojai* - MEXICO: Hidalgo, Puebla
253. *rodriguezi* - MEXICO: Veracruz
254. *rogersi campestris* - U.S.: Florida
255. *rogersi expletus* - U.S.: Florida
256. *rogersi ochlocknensis* - U.S.: Florida
257. *rogersi rogersi* - U.S.: Florida
258. *ruthveri ruthveni* - MEXICO: Veracruz
259. *ruthveni zapoapensis* - MEXICO: Veracruz
260. *seminolae* - U.S.: Florida
261. *shermani* - U.S.: Alabama, Florida, Louisiana, Mississippi
262. *simulans regiomontanus* - MEXICO: Nuevo León
263. *simulans simulans* - U.S.: Arkansas, Colorado, Kansas, Louisiana, New Mexico, Oklahoma, Texas
264. *spiculifer* - U.S.: Alabama, Florida, Georgia, South Carolina?
265. *suttkusi* - U.S.: Alabama, Florida
266. *tenuis* - U.S.: Arkansas, Oklahoma
267. *texanus* - U.S.: Texas
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269. *tlapacoyanensis* - MEXICO: Veracruz
270. *toltecae* - MEXICO: San Luis Potosí
271. *troglodytes* - U.S.: Georgia, South Carolina
272. *truculentus* - U.S.: Georgia
273. *tulanei* - U.S.: Arkansas, Louisiana
274. *vazquezae* - MEXICO: Veracruz
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276. *verrucosus* - U.S.: Alabama
277. *versutus* - U.S.: Alabama, Florida, Georgia
278. *viaeviridis* - U.S.: Alabama, Arkansas, Louisiana, Mississippi, Tennessee
279. *villalobosi* - MEXICO: San Luis Potosí
280. *vioscai* - U.S.: Arkansas, Louisiana, Mississippi
281. *williamsoni* - GUATEMALA.-- HONDURAS
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283. *zihuateutlensis* - MEXICO: Puebla

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284. *maclanei* - U.S.: Florida

APPENDIX II

Alphabetical List of Countries and States, or Provinces, and Their Crayfish Faunas

Only those political units from which crayfishes are known to occur are included. The bibliographic citations are to regional summary works listed in the "References" that should be helpful in studying the crayfishes of the various areas. The numbers refer to the list of species in Appendix I.

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